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Invasive Plants of the Southern California Mountains and Foothills

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On the cover: Spanish broom (*Spartium junecum*, pg. 18) in flower, July 2014. Photo by Mary Crawford.

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In partnership with

Chicago Botanic Garden
Mary Crawford and Adrienne Simmons

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Introduction

What is an invasive species?

Many terms are used to describe an undesirable plant species, but whether a plant is actually "undesirable" is context-dependent. For example, a native species may be considered a nuisance in agricultural lands, but may be an important food source for wildlife. On the other hand, a formerly valued ornamental species might have become an aggressive invader of wildlands.

Weed: The term "weed" or "weedy" describes a plant that is considered a nuisance in gardens, lawns, pastures and croplands. Many native species are considered weedy.

Non-native, alien, exotic: These terms are used interchangeably to describe a species that does not occur naturally in an area, but "alien" and "exotic" are less objective terms and usually imply that a species is considered problematic.

Waif: This term describes non-native species that establish only temporary populations in their introduced range, and don't persist.

Naturalized: Non-native plants that have established stable populations, but that aren't especially aggressive, are considered to be "naturalized".

Non-native invasive plant (NNIP): Non-native invasive plants are both expanding their ranges, and may significantly impact native species and ecosystems.

Noxious: "Noxious" is an official federal designation for especially problematic weed species.

Common threads

As you read the species profiles throughout this book, you'll likely notice themes within the information under each major heading (Origin/ Distribution, Ecology, Life History, Notes).

ORIGIN There may be a "lag time" between when a plant is introduced, and when it's recognized as being seriously invasive. This might simply be because it wasn't collected or observed for a time; it might be hard to see, or there might be few experts in the area who could recognize it as a non-native. However, this observed "lag time" is a real population trend, at least in some species. Saharan mustard (*Brassica tournefortii*, pg. 60) is an example of a plant that occurred only sporadi-

glauca Graham. Tucson, AZ. U.S. Geological Survey/Southwest Biological Science Center, Sonoran Desert Field Station. | ***Pennisetum setaceum* (Forssk.)** | D'Antonio, C. M.; Vitousek, P. M. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. Annual Review of Ecology and Systematics 23.1: 63-87. | ***Ranunculus testiculatus* Crantz |** Buchanan, B. A.; Harper, K. T.; Frischknecht, N. C. 1978. Allelopathic effects of bur buttercup tissue on germination and growth of various grasses and forbs in vitro and in soil. Western North American Naturalist, 38.1: 90-96. | Davis, J. N.; Harper, K. T. 1990. Weedy annuals and establishment of seeded species on a chained juniper-pinyon woodland in central Utah. In Proceedings: Symposium on Cheatgrass Invasion, Shrub Die-off and Other Aspects of Shrub Biology and Management. USDA Forest Service General Technical Report INT-276: 79-82. | eFloras.org. Flora of North America, *Ranunculus testiculatus*. http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233501210. (3 March 2014). | ***Robinia pseudoacacia* L. |** Hunter, J. 2000. *Robinia pseudoacacia*. In: Bossard, C. C., J.M. Randall and M. C. Hoshovsky. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA: 273-276. | Stone, Katharine R. 2009. *Robinia pseudoacacia*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2014, January 8]. | ***Rubus armeniacus* Focke |** Caplan, J. S.; Yeakley, J. A. 2006. *Rubus armeniacus* (Himalayan blackberry) occurrence and growth in relation to soil and light conditions in western Oregon. Northwest Science 80.1: 9. | Evans, K. J.; Symon, D. E.; Hosking, J. R.; et. al. 1999. Towards improved biocontrol of blackberries. Proceedings of the Twelfth Australian Weeds Conference: 325-329. | Osterbauer, N.; A. Trippe; K. French; T. Butler. 2005. First report of *Phragmidium violaceum* infecting Himalaya and evergreen blackberries in North America. Plant Health Progress. | Willis, A. J.; Kilby, M. J.; McMaster, K.; Cullen, J. M.; Groves, M. H. 2003. Predictability and acceptability: potential for damage to non-target native plant species by biological control agents for weeds. Pg. 35-49. In: Jacob, H. Spafford; Briese, D.T. (editors). Proceedings of the CRC for Australian Weed Management biological control of weeds symposium and workshop: improving the selection, testing and evaluation of weed biological control agents. (CRC for Australian Weed Management, Glen Osmond, South Australia). | ***Salsola* species |** Ayres, D., Ryan, F. J., Grotkopp, E., Bailey, J., & Gaskin, J. (2009). Tumbleweed (*Salsola*, section Kali) species and speciation in California. *Biological invasions*, *11* (5), 1175-1187. | Evans, R. A., & Young, J. A. (1980). Establishment of barbwire Russian thistle in desert environments. *Journal of range management*, 169-173. | Gaskin, J. F., Ryan, F. J., Frederic Hrusa, G., & Londo, J. P. (2006). Genotype diversity of *Salsola tragus* and potential origins of a previously unidentified invasive *Salsola* from California and Arizona. *Madroño*, *53*(3), 244-251. | Hrusa, G. F., & Gaskin, J. F. (2008). The *Salsola tragus* complex in California (Chenopodiaceae): characterization and status of *Salsola australis* and the autochthonous allopolyploid *Salsola ryanii* sp. nov. *Madrono*, *55*(2), 113-131. | Longland, W. S. (2007). Desert rodents reduce seedling recruitment of *Salsola paulsenii*. *Western North American Naturalist*, *67*(3), 378-383. | Orloff, S. B. , D. W. Cudney, C.L. Elmore, and J. M. DiTomaso. 2008. University of California Agriculture and Natural Resources Publication 7486: Russian Thistle Pest Notes. | Ryan, F. J., & Ayres, D. R. (2000). Molecular markers indicate two cryptic, genetically divergent populations of Russian thistle (*Salsola tragus*) in California. *Canadian Journal of Botany*, *78*(1), 59-67. | Young, J. A., & Evans, R. A. (1979). Barbwire Russian thistle seed germination. *Journal of Range Management Archives*, *32*(5), 390-394. | ***Tamarix aphylla* (L.) H. Karst, *T. chinensis* Lour., *T. gallica* L., *T. parviflora***

Vol. 7, pgs. 419-424, 436-437. | ***Hydrilla verticillata* (L. f.) Royle |** Akers, P. and *Hydrilla* Eradication Program staff. 2012. California Department of Food and Agriculture *Hydrilla* Eradication Program Annual Progress Report. | Blackburn, R. D., Weldon, L. W., Yeo, R. R., & Taylor, T. M. (1969). Identification and distribution of certain similar-appearing submersed aquatic weeds in Florida. *Hyacinth Control J*, *8*(1), 17-21. | "*Hyrdilla* Annual Report: 2012 Executive Summary". California Department of Food and Agriculture Plant Health and Pest Prevention Services/Integrated Pest Control, *Hydrilla* Program. Web. Accessed Jan. 15, 2014. <www.cdfa.ca.gov/plant/IPC/hydrilla/hydrilla_hp.htm>. Cook, C. D. K. and R. Lüönd. 1982. A Revision of the Genus *Hydrilla* (Hydrocharitaceae). Aquatic Botany, 13: 485-504. | USDA, NRCS. 2014. The PLANTS Database. (http://plants.usda.gov, 7 January 2014). National Plant Data Team, Greensboro, NC 27401-4901 USA. | ***Linaria dalmatica* L. (Mill.) subsp. *dalmatica* | Jacobs, J. S.; Sheley, R. L. 2003.** Prescribed fire effects on Dalmatian toadflax. Journal of Range Management 56.2: 193-197. | ***Ludwigia* species [*L. peploides* subsp. *montevidensis* (Spreng.) P.H. Raven, *L. hexapetala* (Hook. & Arn.) Zardini et al., *L. grandiflora* (Michx) Greuter & Burdet] |** Ellmore, G. S. 1981. Root Dimorphism in *Ludwigia peploides* (Onagraceae): Structure and Gas Content of Mature Roots. American Journal of Botany Vol 68 no 4 pgs 557-568. | Meisler, J. 2009. Controlling *Ludwgigia hexaplata* in Northern California. Wetland Science and Practice, 26(4): 15-19.| Okada, M., B. J. Grenwell, and M. Jasieniuk. 2009. Clonal spread of invasive *Ludwigia hexapetala* and *L. grandiflora* in freshwater wetlands of California. Aquatic Botany 91 pgs. 123-129. | Sears, A. L. W., J. Meisler, L. N. Verdone, Marin/Sonoma Mosquite and Vector Control District. 2006. Appendix D: Invasive Ludwigia Management Plan for the Laguna de Santa Rosa, Sonoma Co., CA. | Thouvenot, L., J. haury and G. Thiebaut. 2013. A success story: water primroses, aquatic plant pests. Aquatic Conservation: Marine and Freshwater Ecosystems. 23: 790-803. | Zardini, E. M., H. Gu and P. H. Raven. 1991. On the Separation of Two Species within the *Ludwigia uruguayensis* Complex (Onagreaceae). Systematic Botany 12 (2) pgs. 242-244. | ***Myriophyllum aquaticum* (Vell.) Verdc., *Myriophyllum spicatum* L. |** Bossard, C. 2000. *Myriophyllum spicatum* (pgs. 254-258) and Godfrey, K. E. 2000, *Myriophyllum aquaticum* (pgs. 249-254). In: Bossard, C. C., J.M. Randall and M. C. Hoshovsky. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA: 254-258. | Couch, R. and E. Nelson. 1985. *Myriophyllum spictaum* in North America. pg. 8-18. In: Anderson, L. W. J. (editor). Proceedings of the First International Symposium on Watermilfoil (*Myriophyllum spicatum*) and Related Haloragaceae Species. Aquatic Plant Management Society, Washington, DC, USA. | Creed, R. P. 1998. A Biogeographic Perspective on Eurasian Watermilfoil Declines: Additional Evidence for the Role of Herbivorous Weevils in Promoting Declines? Journal of Aquatic Plant Management. 36: 16-22. || Madsen, J. D., J. W. Sutherland, J. A. Bloomfield, L. W. Eichler, and C. W. Bolyen. 1991. The Decline of Native Vegetation Under Dense Eurasian Watermilfoil Canopies. Journal of Aquatic Plant Management. 29: 94-99. | Nelson, E. N. and R. W. Couch. 1985. History of the introduction and distribution of *Myriophyllum aquaticum* in North America. pg. 19-34. In: Anderson, L. W. J. (editor). Proceedings of the First International Symposium on Watermilfoil (*Myriophyllum spicatum*) and Related Haloragaceae Species. Aquatic Plant Management Society, Washington, DC, USA. | Reed C. F. 1977. History and distribution of Eurasian watermilfoil in United States and Canada. Phytologia. vol 36 no 5 pgs. 417-436. | Sheldon, S. P. and R. P. Creed. 1995. Use of a native Insect as a Biological control for an Introduced Weed. Ecological Applications, Vol. 5. No. 4. pgs. 1122-1132. | ***Nicotiana glauca* Graham |** Halvorson, W. L.; Guertin, P. 2003. Factsheet for: *Nicotiana*

cally in southern CA for several decades. **Many plants were introduced through the horticultural trade.** Plants introduced for horticultural and agronomic purposes have tremendous economic and social value, but there is also a history of indiscriminate introduction for ornamental purposes. Today, plants introduced to the horticultural trade are required to undergo a more rigorous risk analysis prior to their entry. However, species are still accidentally introduced, and many non-native invasive plants can still be purchased in nurseries and online.

ECOLOGY Non-native invasive plants can affect ecosystem functions and processes. Examples of these processes include nutrient cycling, disturbance regimes, and food webs. Some NNIP have the potential to alter these processes. For example, non-native annual grasses, such as *Bromus* species, increase fine fuel loads and cause more frequent and widespread fires in desert ecosystems, where fires were historically localized. More frequent fires in turn affect native plant regeneration and nutrient cycling. However, these types of impacts can be hard to study, and compared with the numerous disturbances and stresses that ecosystems are undergoing today, it's not always accurate to attribute a particular change to a single invasive species. **Invasive species can impact native species.** Exotic plants can form *monocultures* (large stands consisting mostly of the invasive species), excluding native species and reducing native plant seedling recruitment. They can outcompete native plants for nutrients, light, water, and space. However, as noted above, it can be difficult to directly attribute the observed decline of a native species to a non-native plant invasion.

LIFE HISTORY Many non-native invasive plants have traits that make them particularly successful colonizers of new habitats. Some examples include an extremely high growth rate, the production of large numbers of seed, and modes of dispersal that allow colonization of new habitats (such as wind). A few non-native plants have unique defense mechanisms or other competitive strategies. Plants that are introduced to new areas might escape predators or diseases present in their native range, which is often a reason for their success in a new environment.

NOTES The use of biological control agents has had varying success and may have unintended consequences. In some cases, biological control agents have been extremely successful in controlling non-native

plants. In other cases, they have been only partially successful or have failed outright. There's also concern that introduced control agents might negatively affect native species that they weren't meant to target. Biological controls are unlikely to be approved for NNIP that are closely related to important crop species (such as Saharan mustard).

What is the purpose of this guide?

This guide is meant to assist in the identification of 71 non-native invasive plant species that occur in the mountains and foothills of southern CA and that are of concern to land managers. Some, such as the *Bromus* species, are ubiquitous. Others, such as water hyacinth (*Eichhornia crassipes*) are thus far known from only a few locations, but could become more widespread. A few, such as water primrose (*Ludwiga* species) and onionweed (*Asphodelus fistulosus*), are not known from the mountains or foothills at all, but occur in adjacent regions and/or are observed to be spreading in southern CA.

Although we hope that this guide will be valuable to botanists and non-botanists alike, the guide was designed and written with the non-botanist in mind. We make every attempt to explain potentially unfamiliar terms in the text, and to avoid using specialized botanical terms. We also emphasize pictures over written plant descriptions. *Italics* emphasize a botanical term, and a definition will follow. A few basic terms that are used throughout the text are defined on pg. vi. The pictures are intended to provide a search image for those not necessarily familiar with the invasive flora of southern CA, but tentative identifications must be confirmed by a botanist or other knowledgeable person.

This is not a comprehensive guide to non-native invasive plants of southern California. Non-native plants whose ranges are confined to coastal areas or lower elevations have been largely omitted from this guide. We have also omitted some species of major concern that are more difficult to identify; non-native invasive grasses are under-represented in this guide. There are many naturalized weed species that are of lesser concern to land managers, and many non-native species are only occasional garden escapees or waifs. For the most part, such species have not been included.

We do not address non-native invasive plant control techniques or best management practices. That information is available from many other resources.

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How should I use this guide?

Species accounts are organized by *habit*, and then alphabetically by the common name of the plant family. A plant's habit is its normal growth form or general shape. The plants included in this guide have been grouped into one of five habits: tree/shrub, vine, forb, grass, and aquatic. Many of the woody plants included in this guide can grow ambiguously as small trees or as large shrubs. To avoid the potential confusion that this distinction might create, we chose to group all woody, perennial species into a general "tree/shrub" category.

Note that the "habit" designation is an artificial organization designed to expedite identification; it doesn't necessarily reflect how species are related to one another. All of the members of the legume family, irrespective of their habit, are more closely related to one another than the woody legumes are to other woody species.

Read the description of each species, and compare the plant to the photos provided. Especially note characteristics of flowers, fruits, and leaves. Although a 10X hand lens is useful for observing small characters, it shouldn't be necessary for most species addressed here. Botanists often consult multiple sources when identifying an unknown plant; if you have access to other guides or keys in the field, they can help you confirm your identification. Don't force characters to match a description, and also understand that you might not be able to make a positive identification. This is especially true for grass species, where identification often relies on knowledge of additional structures and terminology, and careful examination of flowers, leaves, inflorescences, and underground parts.

Definitions and Abbreviations

Ratings The California Invasive Plant Council (CAL-IPC) has assigned ratings to non-native invasive plants that occur in CA and that impact native ecosystems. Plants are classified as "High", "Moderate", or "Limited", and may also have "Alert" status. Alert status supplements a CAL-IPC rating, and indicates that a species has the potential to spread explosively. In this guide, a plant's CAL-IPC rating is indicated by the background color of the habit circle. While these ratings provide a useful context, its extremely important to remember that they are intended to describe a species' cumulative statewide impacts. Therefore, plants that are aggressive only within a limited range in CA may not have a ranking

that accurately describes their impact within that range. **The fact that a non-native plant has a rating of "Limited", or is not rated at all, doesn't mean that it's not a concern or that treatment/removal isn't appropriate.** Also, many non-native plants haven't been the focus of much research, and ratings are developed from reviews of published literature. Therefore, a low or absent rating could simply mean that little data were available to develop one. Ratings, defined by CAL-IPC, are below: **HIGH** "These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically." **MODERATE** "These species have substantial and apparent - but generally not severe - ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread." **LIMITED** "These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic."

Scientific and common names Scientists name species using a system called *binomial nomenclature.* A Latin scientific name has three parts: genus, species, and authority. Within a species, subspecies or varieties may also be described. The *authority* is an abbreviation of the name of the person who originally described the species. For example, the abbreviation "L." means that the species was first described by Carl Linnaeus. For each species in this guide, the authority is available in the bibliography. Common names are given in bold font. Common names are an easy and oftentimes useful way of communicating plant names, but they can also cause confusion. Some plants have multiple common names; for example, *Lathyrus latifolius* has been called "everlasting peavine", "perennial pea", "perennial sweet pea", "weedy sweet pea", and "sweet pea". In this guide, we include the most widely used or referenced common name.

Western States. University of California Agriculture and Natural Resources Pub. 3488.

Range and collection data were provided by the participants of the Consortium of California herbaria (ucjeps.berkeley.edu/consortium/).

Additional data about invasive species range and spread were available from CalWeedMapper: California Invasive Plant Council. 2014. Available at <http://calweedmapper.calflora.org/maps/>.

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Abbreviations: CA=California, NA=North America, NF=National Forest, NorCA=northern California, SoCA=southern California

Basic plant terminiology In order to make the text more accessible, we have omitted a number of botanical terms from this guide. A few terms are consistently included in order to avoid confusion and tedious, repetitive descriptions: ***Petiole***: The petiole is the stalk of a leaf, which attaches the leaf to the stem. ***Basal* and *cauline***: These two terms describe the overall location of leaves on the stem. Basal leaves grow at or near the base of a plant; cauline leaves are attached along the stem. ***Compound* versus *simple***: Compound leaves are comprised of multiple distinct individual lobes or segments. Each distinct segment is called a "leaflet"; leaflets themselves may be divided further. Simple leaves may have small teeth or lobes, but they're deeply divided or branched. ***Inflorescence***: The inflorescence is the group or cluster of flowers and related flower structures. There are various types of inflorescences that describe more specifically how flowers are arranged, but we have generally avoided using these terms.

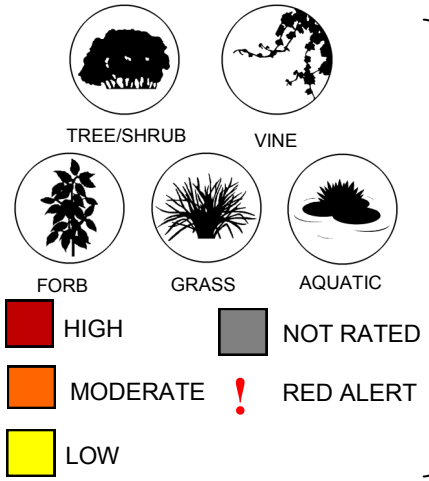
How should I report an invasive species?

If you think you've found one of the species in this guide on National Forest lands, you may report it to Forest Service resources staff via the smartphone app "What's Invasive": **http://whatsinvasive.org.** You'll need to set up an account and provide basic contact information. Alternatively, you may contact the Botanist on your respective National Forest. Please do not pull or remove plants on National Forest Lands, even if you're certain that a species is invasive! It's very important that resource managers are aware of the locations of these species, especially if they aren't yet widespread on public lands. Successful eradication or control of an infestation might require the use of specific treatment methods and/or management over several years. Hand-pulling is oftentimes not the most effective means of control, and might actually contribute to a species' spread. While some widespread invasive species can be managed on a small scale, it isn't practical, or even necessarily desirable, to control them on a landscape scale. Early detection and eradication are the most effective and efficient ways of managing invasive species.

How is this guide organized?

FAMILY **Common name** *Scientific name*

This heading contains the species' Latin scientific name, common name, and family. See page v for an explanation of scientific names.



The "HABIT" circle describes whether the plant is a tree/ shrub, vine, forb, aquatic, or grass. These profiles are only generic representations of the plant's habit; they aren't profiles of the actual species. The color of the habit circle indicates the plant's CAL-IPC status. Explanations of CAL-IPC ratings are on page v.

This space contains information under the following headings:

ORIGIN This heading includes notes about each species' native range, and about how and why it was introduced to California.

DISTRIBUTION This section describes the species' range in SoCA, and may note its continental or global range.

ECOLOGY This space describes what habitats the species can be found in, and also summarizes some of the known or potential impacts that the species has on native plants and ecosystems.

LIFE HISTORY A species' "life history" describes how it grows and reproduces. Information about dispersal mechanisms, seed production and seed germination may be included here.

NOTES This section may include information about biocontrol efforts. There may also be notes about toxicity, if applicable. **The absence of notes about toxicity does not imply that any part of the plant is edible. This guide does not provide complete information about human/ animal toxicity.**

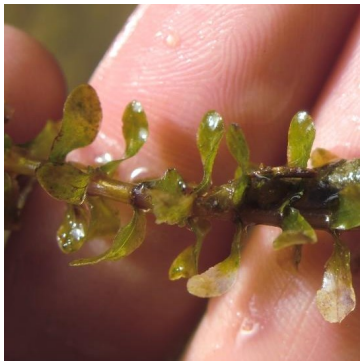
Waterweed family

Brazilian waterweed *Egeria densa*

©2001 CDFA

This South American native was documented in Lake Fulmor (San Jacinto Mtns.) in 1969, but isn't otherwise known from the Transverse or Peninsular Ranges. In CA, it's been collected at elevations up to 2,165 m (7,103 ft). Compared with hydrilla, Brazilian waterweed has larger leaves (1.2-4 cm long, 2-5 mm wide) and longer petals (8-10 mm).

SIMILAR SPECIES Native waterweeds in the genus *Elodea* could be mistaken for hydrilla or Brazilian waterweed. **Common waterweed** (*Elodea canadensis*) has leaves in whorls of 3 or 4.



2014 Mary Crawford

2014 Mary Crawford

Waterweed family

Hydrilla *Hydrilla verticillata*

HABIT Hydrilla is a submersed perennial aquatic. It's often rooted in sediment, but fragments of the plant can survive in a free-floating state. Elevation < 200 m (656 ft), but the species could occur outside that range.

LEAVES are toothed, 1-2 cm long and 1.5-2 (up to 4) mm wide. The underside of the *midrib* (the main vein running down the center of the leaf) often has spines or glands. Leaves are arranged in whorls around the stem.

Tim Krynak

ORIGIN AND DISTRIBUTION Aquatic plant dealers introduced hydrilla to the west coast of Florida in the late 1950s. Hydrilla is believed to be native to central Asia, but it's now found worldwide. The species was first found in CA in 1976. In SoCA, hydrilla has been found in Barstow, San Diego, El Centro, and Yuma. The California Department of Food and Agriculture aggressively manages infestations of hydrilla.

ECOLOGY Hydrilla grows in lakes, reservoirs, canals, and slow-moving rivers. It's tolerant of a wide range of water chemistry conditions; it can be found in low- and high-nutrient lakes and in brackish water. Dense mats of hydrilla slow water flow and impede recreational boating and navigation.

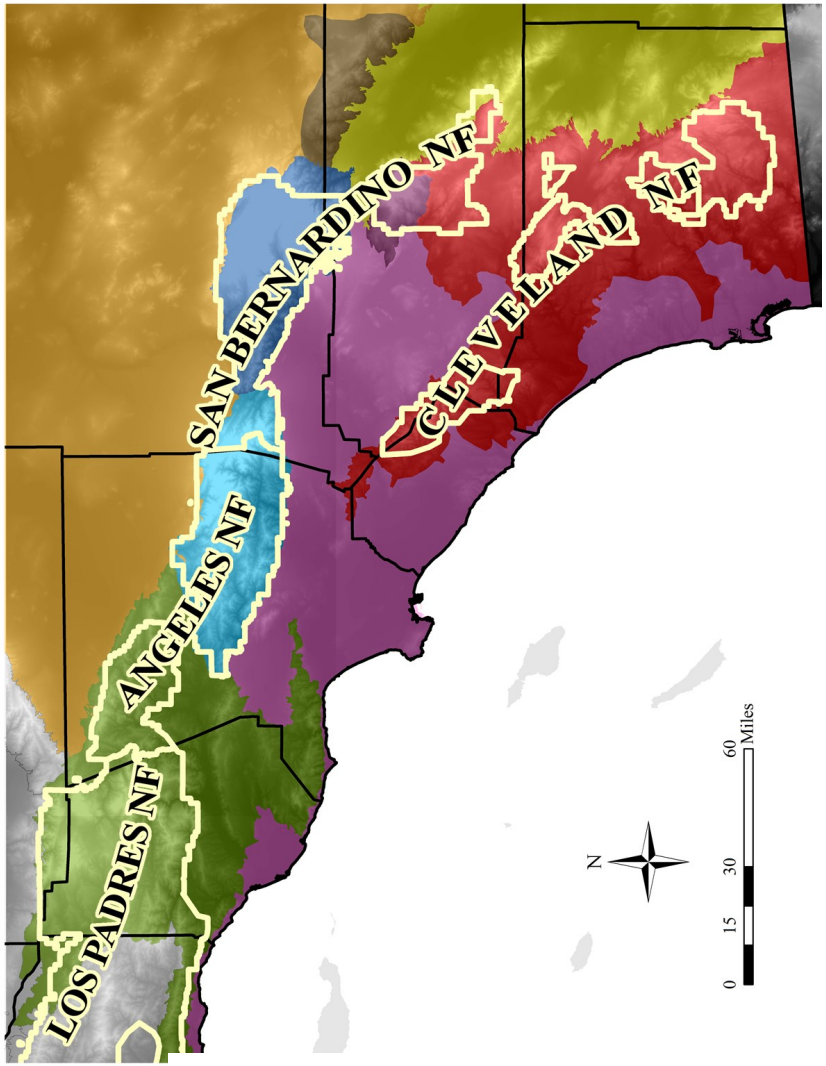
LIFE HISTORY Hydrilla can reproduce vegetatively in several ways. Detached fragments of the stem can develop into mature plants; a new plant may develop from just a single whorl of leaves. Hydrilla also produces compact, dormant buds in its leaf axils (called t*urions*) and at the tips of roots (called *tubers*). In areas heavily invaded by hydrilla, both turions and tubers can be present in the sediment in very large numbers.

This space contains pictures and descriptions of leaves, fruits, flowers, and any other distinctive or specialized structures that may be important for identification. The descriptions of each characteristic may include notes about ***phenology***. Phenology describes when a species emerges, flowers, fruits, and sets seed. However, information about phenology isn't included in the profile of every species. That's because phenology can vary tremendously depending on location and elevation, and phenology can be especially variable in SoCA because of the strong elevational and climactic gradients that exist here. Species that flower only during the spring or summer months at higher elevations may flower year-round along the South Coast.

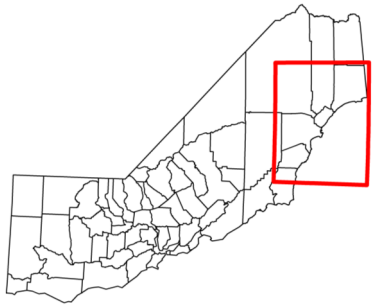
Elevation ranges are given in both meters and feet. Some of the species in this guide have been found below certain elevations, and are unlikely to occur or persist at higher elevations. However, keep in mind that the species in this guide are spreading in many areas, and that they could occur at higher elevations than have been documented thus far. Also, published elevation ranges are based on data available from plant collections documented in herbaria; under-collected or overlooked species may occur outside their given ranges. As defined by Munz (1968) and as applied to SoCA, the term "cismontane" refers to regions south and west of the crests of the Peninsular Ranges, San Bernardino Mtns., and San Gabriel Mtns. (this includes the South Coast). The Western Transverse Ranges are also considered cismontane. "Transmontane" refers to regions north and east of the crests of the Peninsular Ranges, San Bernardino Mtns., and San Gabriel Mtns. (this includes desert regions., map pg. ix).

The "Habit" section defines whether the plant is an annual, a biennial, or a perennial. An annual completes its life cycle in one year, sets seed, and dies. A biennial completes its life cycle in two years, often as a rosette in the first year. A perennial lives for more than two years.

SIMILAR SPECIES Many non-native invasive plants appear superficially similar to other species, both native and non-native. This section highlights some plants that could be confused with the non-native species in question. A few of the NNIP in this guide look similar to rare species. In general, this section only addresses similar species that occur in the SoCA mountains and foothills, but in a few cases, we include similar species that occur in adjacent desert regions.

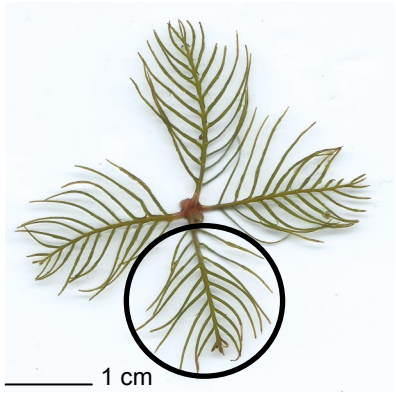


Southern California Geographic Subdivisions and National Forest Lands

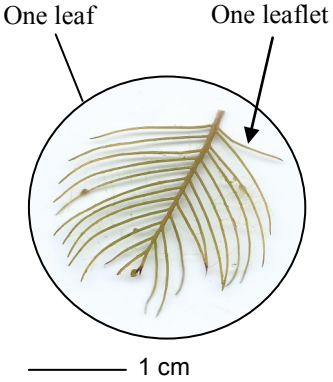


Geographic subdivisions of California were developed for the first edition of The Jepson Manual, Higher Plants of California (J. C. Hickman, ed., 1993).

SIMILAR SPECIES Four native species of watermilfoil occur in CA; two have been collected in the Transverse Ranges. **Siberian watermilfoil** (*M. sibiricum*) occurs in numerous lakes in the San Bernardino Mtns. It is most similar to Eurasion watermilfoil, but differs in having fewer pairs of leaflets (4-14 pairs, or less than 28 leaflets).



Watermilfoil leaves are attached in whorls around the stem



Inflorescence of Siberian watermilfoil. Both male and female flowers are present; the female grow below, the male above. The inflorescence of Eurasian watermilfoil is similar.

Male (*staminate*) flowers

Female (*pistillate*) flowers

Water-milfoil family (continued)

Eurasian watermilfoil *Myriophyllum spicatum*

Barry Rice

HABIT Perennial. Elevation < 2,080 m (6,824 ft). **LEAVES** are whorled, less than 3 cm long, and have greater than or equal to 28 segments (14-24 pairs of segments).

Parrott's feather *Myriophyllum aquaticum*

Leslie Mehrhoff

Leslie Mehrhoff

HABIT Perennial. In CA, it's been found at 2,054 m (6,738 ft), but all other collections are below 849 m (2,785 ft). Plants produce either only male or only female flowers; male plants have not been found in NA. Parrott's feather stems may rise above the water. **LEAVES** are whorled, 1.5-3.5 cm long, and 0.3-1 cm wide. Each leaf has 20-30 segments.

Legend

National Forest lands

County boundary

Southwestern California (excluding Channel Islands)

- Transverse Ranges
  - Western Transverse Ranges
  - San Gabriel Mtns.
  - San Bernardino Mtns.
  - San Jacinto Mtns.
  - Peninsular Ranges
  - South Coast
- **Desert Province**
  - *Sonoran Desert*
  - *Mojave Desert*
  - Desert Mountains

How are geographic subdivisions useful? Because these subdivisions delineate regions of CA according to vegetation, climate, and geology, they're an ecologically meaningful way of describing a species' range. Different regions might be vulnerable to invasion by different non-native species, based on factors such as elevation and climate.

For information on the geographic scope of this guide, see page iii.

Note: The system of CA geographic subdivisions is three-tiered at the levels of province, region, and subregion. Southwestern CA is a region within the California Floristic Province. The Desert Province contains two regions, the Mojave and Sonoran Deserts. In the legend, **bold** indicates a province, *italics* a region, plain text a subregion. The Transverse Ranges are considered a single region; the three ranges that comprise it are indicated in SMALL CAPS.

Legume family

Black locust *Robinia pseudoacacia*

Paul Wray

2014 Mary Crawford

HABIT Tree. Elevation < 1,900 m (6,233 ft). **LEAVES** are deciduous, alternate, and compound, with 7-19 leaflets.

ORIGIN AND DISTRIBUTION Black locust is native to the southeastern United States. It's been widely planted outside of its original range for ornamental purposes, mine reclamation, and erosion control. Black locust occurs throughout CA and the SoCA Mtns., and is spreading in the San Gabriel Mtns.

ECOLOGY Within its native range in the eastern U.S., black locust is an opportunistic, early successional tree that can grow rapidly after disturbance. However, it is not a dominant component of mature forests. In SoCA black locust has been documented in chaparral, oak woodlands, grasslands, coastal sage scrub, and riparian areas. Like many members of the legume family, black locust fixes nitrogen.

LIFE HISTORY Following disturbance such as fire or cutting, black locust can sprout vigorously from its roots and stumps. Black locust also reproduces by seeds, which may be relatively long-lived in soil (1-39 years). However, vegetative spread - through root and stump sprouting - is a more important mode of reproduction.

Water-milfoil family

Eurasian watermilfoil and parrot's feather

2014 Mary Crawford

ORIGIN **Eurasian watermilfoil** is native to Eurasia and North Africa. It's unclear whether Eurasian milfoil spread from the eastern U.S. to CA, or whether it was separately introduced to the west coast. **Parrot's feather** is native to South America and was introduced to the U.S. in the 1880s. Both watermilfoil species were sold in the U.S. for use in aquaria.

ECOLOGY AND LIFE HISTORY The invasive watermilfoil species can be found in a variety of aquatic habitats. Mats of both Eurasian watermilfoil and parrot's feather are a nuisance in lakes and rivers, where they may impede swimming and boating. Dense stands of milfoil may also impact commercial navigation and block irrigation channels and drainages. Both watermilfoil species are easily spread to new waterbodies on boats and trailers. The watermilfoil species generally reproduce vegetatively by growing from fragments of leaves and stems.

NOTES Beginning in the 1960s, a number of researchers observed declines in Eurasian watermilfoil populations in lakes throughout the U.S. and Canada. In some cases Eurasian watermilfoil populations remained low after the initial decline; in others, declines lasted for only one season. Many of these declines have been attributed to the milfoil weevil (*Euhrychiopsis lecontei*), which normally feeds on the native *Myriophyllum sibiricum.*

Pondweed family

Curly leaf pondweed *Potamogeton crispus*

Leslie Mehrhoff

HABIT Submersed aquatic. Elevation < 2,100 m (6,900 ft). **LEAVES** are finely toothed and have undulating margins.

ORIGINS AND DISTRIBUTION Curly leaf pondweed was first documented in CA in 1896. The species is believed to have spread through fish hatchery operations. Curly leaf pondweed has been found in scattered lakes throughout the SoCA mountains, but collections are concentrated in reservoirs in the San Bernardino Mtns.

ECOLOGY Curly leaf pondweed can establish large weed beds in lakes. These weed beds are a nuisance to boaters and other recreationists, and may alter aquatic food webs.

LIFE HISTORY For an aquatic plant, curly leaf pondweed has a somewhat atypical life cycle: it is a "winter annual". Young shoots germinate in fall. In winter, curly leaf pondweed may grow slowly or not at all, depending on water temperatures. The shoots grow rapidly in spring, and by early summer the plant senesces. Curly leaf pondweed spreads to new waterbodies on boats and trailers, and can also be spread by waterfowl.

2014 Mary Crawford

2014 Mary Crawford

FRUITS are smooth. A narrow band of tissue (the "wing") runs the length of the seed pod. **TWIGS** have thorns.

2012 Julie Nelson

2006 Chris Wagner/SBNF

FLOWERS (May-June) are white. They are arranged on a drooping inflorescence that's covered with fine hairs.

SIMILAR SPECIES **Desert ironwood** (*Olneya tesota*) might be confused with black locust. It has pink flowers. Although it isn't known from the SoCA mountains, it occurs just east of Palm Springs, in the Sonoran Desert. **Desert locust** (*Robinia neomexicana*) is rare in the Mojave Desert, and also has pink flowers.

©2011 Neal Kramer

Desert ironwood, NATIVE

Legume family

Spanish broom *Spartium junceum*

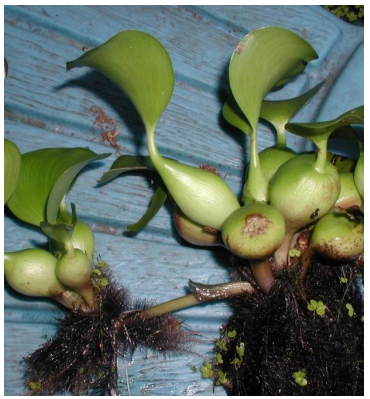
Lizzy Eichorn

Dev Kopp/SBNF

HABIT Spanish broom has numerous stems and is generally < 10 ft tall. It occurs at least up to 2,132 m (7,000 ft), and possibly higher. The smooth **STEMS** are round in cross-section.

ORIGIN Spanish broom is native to the Mediterranean region and was introduced to CA in the mid-19th century as an ornamental. Between the 1930s and 1960s, it was planted along mountain highways in SoCA.

ECOLOGY AND LIFE HISTORY All three broom genera readily colonize disturbed areas. These may include roadsides, clearcuts, eroding slopes, washes, and post-burn areas. The brooms also grow in open forests, grasslands, and shrublands. Brooms resprout vigorously post-fire, and can form dense stands that may outcompete native species. Like many members of the legume family, broom species are able to fix nitrogen. This allows them to thrive on poor soils, and may give broom species a competitive advantage over native, non-leguminous species whose growth may be partially limited by the inavailability of nitrogen. Stems of broom photosynthesize year-round. This provides the plants with an energy source even after their leaves have died. Brooms seed heavily, creating a large and long-lived seed bank.



Leslie Mehrhoff

Leslie Mehrhoff

LEAVES are heart-shaped and grow from the base of the plant. Water hyacinth has an inflated petiole (above, both pictures) that gives the plants buoyancy.

Leslie Mehrhoff

Wilfredo Robles

FLOWERS are blue or violet and have 6 petals. The inflorescence contains fewer than 30 flowers.

SIMILAR SPECIES Pickerel-weed (*Pontederia cordata*) also has leaves with heart-shaped bases and an inflorescence of blue flowers. In SoCA, pickerel-weed has been found only in Riverside Co. The inflorescence of pickerel-weed has more than 50 flowers.

Chris Evans

Karan Rawlins

Pickerel-weed, NON-NATIVE (to CA)

Pickerel-weed family

Water hyacinth *Eichhornia crassipes*

Graves Lovell

HABIT Water hyacinth is a free-floating aquatic. Plants are connected by *stolons*, which are thin horizontal stems which resemble roots.

ORIGIN AND DISTRIBUTION Water hyacinth is native to the Amazon Basin, but has invaded tropical and sub-tropical freshwater ecosystems worldwide. It was introduced to CA in Sacramento in 1904 as a pond ornamental, and now occurs in the Central Valley, the San Francisco Bay area, and in southwestern CA. Water hyacinth has been collected from only two sites in the Transverse Ranges.

ECOLOGY Water hyacinth is often cited as one of the most invasive plants in the world. It forms dense, interlocking mats that impede fishing, recreation, and navigation. Scientists have found that dissolved oxygen concentrations below these mats are many times lower. Water hyacinth may also alter food-web structures, although its impact may vary depending on the ecosystem in question. Several traits make water hyacinth a successful competitor outside of its native range. Water hyacinth has an extremely high growth rate. And because it is free-floating, water hyacinth is not limited to shallow waters.

2014 Mary Crawford

LEAVES are simple, deciduous, and short-lived.

Lizzy Eichorn

FLOWERS (Mar.-July) are yellow and fragrant.

Lizzy Eichorn

2014 Mary Crawford

FRUITS (June-Oct.) are covered with fine hairs. At maturity, the fruits split and release seeds. Seed pods remain on the plant into winter.

SIMILAR SPECIES Three genera - *Cytisus*, *Spartium*, and *Genista* - are referred to as "brooms". All are within the legume family and are upright, perennial shrubs with many-branched green stems. While differing in some aspects of their distribution, ecology, and life history, the brooms share many traits that make them successful competitors in CA.

Spanish broom is the only genus of *Spartium* in CA, but could be confused with the related French and Scotch brooms. Spanish broom has simple, deciduous leaves, round, smooth stems, *dehiscent* fruits (meaning that the fruits open at maturity), and fragrant, yellow flowers. Refer to the profiles of *Cytisus* and *Genista* for further comparison.

Legume family

Scotch broom *Cytisus scoparius*

©20009 Zoya Akulova

2014 Mary Crawford

HABIT Scotch broom is < 10 ft tall. Plants can live for up to 17 years. Elevation at least up to 2,100 m (6,900 ft). **FLOWERS** are smooth and grow singly or in pairs from the axils of leaves. **FRUITS** are mostly smooth, but the edges are covered with white hairs.

2014 Mary Crawford

2014 Mary Crawford

LEAVES are deciduous, compound, and have 1 to 3 leaflets. **STEMS** have 5 ridges and are star-shaped in cross-section. The photo at right compares the stem of Scotch broom (left) with the smooth stem of Spanish broom.

ORIGIN AND DISTRIBUTION Scotch broom is native to Europe. It was introduced to CA in the 1850s as an ornamental, and was subsequently planted to stabilize dunes and for erosion control. Scotch broom isn't common in the Transverse or Peninsular Ranges.

Floating primrose-willow

Ludwigia peploides subsp. *montevidensis*

HABIT Floating primrose-willow is a floating or creeping perennial. Plants are generally hairy. **FLOWERS** have 4-6 yellow petals. Petals are 10-22 mm long. Water primroses have *sepals* that persist after the petals have dropped off the flower. Sepals are the lowermost whorl of a flower. They are often green and grow just below the petals.

©2010 Barry Breckling

Uruguayan primrose-willow

Ludwigia hexapetala

HABIT **Uruguayan primrose-willow** and **large-flowered primrose-willow** are both perennials or short-statured shrubs and are emergent in wetlands. Elevation < 300 m (980 ft). **FLOWERS** have 5 yellow petals; petals are 18-29 mm long. Large-flowered primrose-willow is very similar to Uruguayan primrose-willow, but has shorter petals (15-18 mm) and sepals (8-12 mm).

©2012 Zoya Akulova

Ludwigia hexapetala

SIMILAR SPECIES There are six taxa of *Ludwigia* in CA. ***Ludwigia repens*** (native) occurs only in southwestern CA. It has opposite leaves and 4 petals. ***Ludwigia peploides* subsp. *peploides*** also occurs in southwestern CA. It is most similar to *L. p.* subsp. *montevidensis*, but is generally smooth, with petals 9-13 mm long.

Evening-primrose family

Water primroses *Ludwigia* species

©2012 Aaron Arthur

ORIGIN AND DISTRIBUTION All three invasive water-primrose species that occur in CA are native to South America. Collections of **large-flowered primrose-willow** (*L. grandiflora*) are concentrated in San Diego. **Uruguayan primrose-willow** (*L. hexapetala*) occurs in wetlands north of Sacramento and San Francisco, and is also known from the Western Transverse Ranges. **Floating primrose-willow** (*L. peploides* subsp. *montevidensis*) is known only from central CA.

ECOLOGY In CA, the invasive water-primrose species are found in shallow, slow-moving waters in rivers, canals, and lake margins. In these habitats, they can form dense mats of woody stems. These mats affect the growth of native wetland species, and also reduce the amount of open-water habitat available for wildlife. By slowing water flow, trapping sediment, and filling flood-control channels, the invasive water-primroses could reduce a wetland's capacity for flood retention.

LIFE HISTORY Fruits can float and produce numerous small seeds. However, in CA, genetic studies have found that vegetative reproduction - when mats and shoot fragments become detached and colonize new areas - is the primary means of water-primrose spread.

Legume family

Portugese broom *Cytisus striatus*

©2011 Vernon Smith

©2007 Zo ya Akulova

HABIT Mature plants are generally 6.5-10 ft tall. Elevation at least up to 1,860 m (6,102 ft). **STEMS** have 8 to 10 ridges. **FLOWERS** are yellow and grow singly or in pairs from the axils of the leaves. They are covered with small, short hairs. **FRUITS** are covered with dense white hairs.

DISTRIBUTION Portuguese broom isn't widespread in CA, but there's concern that it could expand its range. It's been collected from locations in the San Francisco Bay area and from a few places in the SoCA Mtns.

SIMILAR SPECIES Compared with Scotch broom, Portuguese broom has 8-10 ridges on its stem instead of 5. The entire fruit is covered with hairs.

Legume family

French broom *Genista monspessulana*

John M. Randall

©2008 Neal Kramer

HABIT French broom is usually less than 10 ft. tall, but may grow to 16 ft. Plants live for 10 to 15 years. Elevation < 800 m (2,624 ft). **STEMS** have 8 to 10 ridges. **LEAVES** are compound, with 3 leaflets. They may be evergreen or deciduous.

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©2010 Neal Kramer

FRUITS are covered with white hairs. At maturity, they open to release seeds. **FLOWERS** grow in clusters of 4 to 10.

ORIGIN AND DISTRIBUTION French broom is native to the Mediterranean region and was introduced to CA in the mid-19th century as an ornamental. In CA, French broom is found primarily in the northern coastal ranges, the northern Sierra Nevadas, and the San Francisco Bay area. French broom is less tolerant of frost than Scotch broom and is therefore limited to lower elevations; it's been collected only on southern slopes of the Transverse Ranges.

Grass family

Bermuda grass *Cynodon dactylon*

2014 Mary Crawford

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Bermuda grass has minute flowers (above).

HABIT Creeping perennial grass. It occurs at elevations up to 2,000 m (6,561 ft). The image above shows and an inflorescence of Bermuda grass (left) as well as a section of vegetative stem (right). **INFLORESCENCES** are upright and have 4-7 slender branches.

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Vegetative stems are horizontal. **LEAVES** are less than 6 cm long.

ORIGIN, DISTRIBUTION AND LIFE HISTORY Bermuda grass is native to Africa and is found throughout most of CA. Like Kikuyu grass, it was planted as a turfgrass. Bermuda grows in disturbed places, and can spread by creeping roots. This grass can also grow from root and stem fragments.

Grass family

Kikuyu grass *Pennisetum clandestinum*

©2009 Barry Rice

HABIT Creeping perennial grass up to 1.5 ft tall. Elevation <100 m (328 ft). **LEAVES** are 1.5-30 cm long and 4-8 mm wide.

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The tiny flowers of kikuyu grass (right) barely reach the tops of the tallest leaves.

ORIGIN AND DISTRIBUTION This grass is native to Africa and was planted in CA for erosion control and as turfgrass. It's been found in the foothills of the Transverse and Peninsular Ranges. kikuyu grass grows in disturbed places. A patch of kikuyu grass can spread by creeping roots, and new plants can grow from root and stem fragments.

SIMILAR SPECIES (to all broom genera) A number of shrub species native to CA have upright stems that remain green throughout the year. In flower, brooms are easily recognizable as members of the legume family. Later in the year, look for seed pods that haven't fallen off the plant; they can be present well into winter. Stem characteristics can also help with out-of-season identification. Spanish broom has very smooth stems; the stems of French, Spanish, and Portuguese broom are variously angled. From a distance, several native shrub species in the sunflower family could also superficially resemble broom.

Deerweed (*Acmispon* species), NATIVE. Like the broom species, deerweeds are in the legume family. Fourteen species occur in the SoCA mountains. Those that are upright shrubs have flowers which grow from a central point on the stem.

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Mormon tea (*Ephedra* species), NATIVE. Mormon tea is closely related to our conifer species. It has no leaves, and small cones form on its stems.

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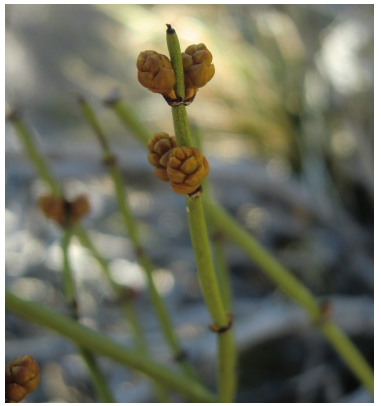

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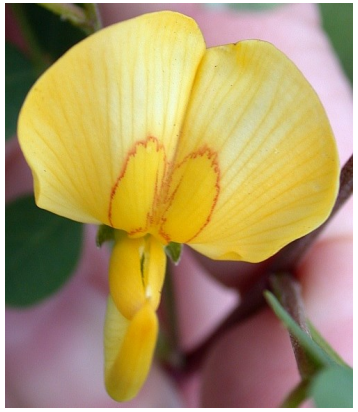
Legume family

Bladder senna *Colutea arborescens*

Robert Vidéki

©2003 Jennifer Forman

HABIT Branched deciduous shrub. Elevation at least to 2,133 m (7,000 ft). **LEAVES** are compound, with 9-13 leaflets.



©2003 Jennifer Forman

FLOWERS have a darker yellow or lined mark.

©2003 Jennifer Forman

FRUITS are inflated, papery, and 2-3 cm long

ORIGIN, DISTRIBUTION AND ECOLOGY This showy shrub is native to southern Europe. It's been collected relatively few times in CA, and occurrences in NorCA are sporadic and likely cultivated. However, in SoCA, multiple populations have been found in the San Gabriel Mtns. The species appears to be spreading and is a concern to land managers on the Angeles NF. In the San Gabriel Mtns., bladder senna has been found in chaparral and coastal sage scrub habitats.

Grass family

Rabbitfoot grass *Polypogon monspeliensis*

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HABIT Annual. Elevation < 2,100 m (6,890 ft.) The fine, silvery awns give the inflorescence of rabbitfoot grass a soft, fluffy appearance.

ECOLOGY Rabbitfoot grass grows in moist and seasonally wet areas throughout CA. These may be streamsides, ditches, or pastures. In the SoCA mountains, rabbitsfoot grass grows near creeks and streams. Rabbitfoot grass is also known as "annual beard grass".

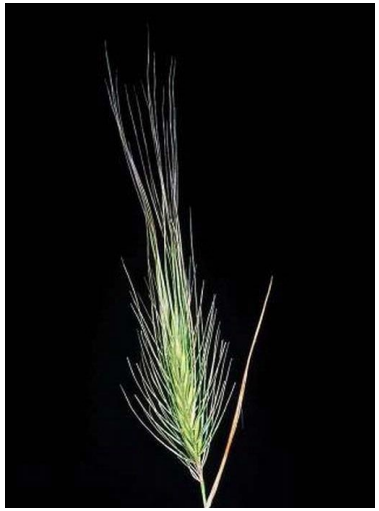
LIFE HISTORY Rabbitfoot grass can be either a summer or a winter annual, depending on the region. At higher elevations and/or in colder climates, it germinates in spring and flowers and seeds through the summer. Seeds may be dispersed by water.

SIMILAR SPECIES There are six species of *Polypogon* in CA (the genus is known as "beard grass"). It can be difficult to identify the beard grasses to species level; they are distinguished by characteristics of the flower/fruit parts. All are non-native, but only rabbitfoot grass is considered invasive.

Grass family

Medusahead grass *Elymus caput-medusae*

Joseph DiTomaso



Joseph DiTomaso

HABIT Winter annual. Elevation < 2,100 m (6,890 ft). Medusahead grass grows to 2 feet tall, and the spikes bend horizontally. **IDENTIFICATION** The awns (definition pg. 109) of Medusahead grass are 3-7 cm long. They twist when dry, which gives "Medusahead" grass its name. This grass matures a few weeks later than most annual grasses, and also grows later into the season. Therefore, it can be conspicously green when other annual grasses have set seed. The inflorescence is solitary and unbranched, and the spikelets are attached directly to the axis of the inflorescence in clusters of 2-4.

DISTRIBUTION, ECOLOGY AND LIFE HISTORY Medusahead grass has been found in only a few places in SoCA, but there's concern that it could spread; it's abundant and spreading in many areas of NorCA. Plants grow densely, and the dead stems form a thick thatch that inhibits the growth of other species.

SIMILAR SPECIES Medusahead grass is the only annual *Elymus* in CA. All other *Elymus* are perennial and have more extensive root systems. Other *Elymus* and some species of *Hordeum* have a superficially similar inflorescence.

Nightshade family

Tree tobacco *Nicotiana glauca*

2006 Chris Wagner/SBNF

2014 Adrienne Simmons

HABIT Shrub/tree up to 23 ft with soft, smooth bark. Elevation < 1100 m (3608 ft). **LEAVES** are alternate and 5-21 cm long.

©2009 Thomas Stoughton

FLOWERS are yellow, tubular, and up to 3.5 cm long.

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FRUITS are brown capsules that open to release seeds.

ORIGIN, DISTRIBUTION AND ECOLOGY Tree tobacco is native to South America; it was probably introduced to CA as an ornamental. It occurs most frequently in the Central Valley, the Peninsular Ranges, and the foothills of the Transverse Ranges. Tree tobacco can be found in disturbed areas, washes, and riparian areas with sandy and gravely soils. As a defense against herbivory, tree tobacco produces a chemical in its leaves, which is toxic to humans and animals when ingested.

Mulberry family

Edible fig *Ficus carica*

2009 Julie Nelson

©2009 Thomas Stoughton

HABIT Deciduous shrub or tree, up to 34 ft tall. Elevation < 800 m (2,624 ft). Edible fig often has more than one trunk.

2013 Adrienne Simmons

FRUITS turn purple when ripe. Plants ooze milky sap when cut.

2013 Adrienne Simmons

LEAVES are alternate, have 3-7 lobes, and are 11-32 cm long.

ORIGIN, ECOLOGY AND LIFE HISTORY Edible fig was introduced to CA by Spanish missionaries. It has escaped cultivation in many areas, and is especially problematic in riparian woodlands in the Central Valley. Edible fig grows in moist riparian areas and canyons, on canal banks, in disturbed places, and near old homesteads. It's found in places where soil moisture is consistent throughout the year. Fig reproduces by seed, and new stems can also form from cut twigs. The shallow, spreading roots send up shoots to form dense thickets.

Grass family

Barb goatgrass *Aegilops triuncialis*

Joseph M. DiTomaso

HABIT Winter annual. Barb goatgrass is < 1.5 ft tall. Elevation < 1,000 m (3,280 ft). There are two other *Aegilops* in CA; *A. cylindrica* is considered invasive and *A. neglecta* could become so.

©2009 Barry Rice

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ORIGIN AND DISTRIBUTION This Mediterranean annual grass is spreading in areas around San Francisco and in the Sierra Nevadas. A few populations have been found in San Diego Co, and there's concern that it could spread to other parts of SoCA.

IDENTIFICATION NOTES Barb goatgrass is easily confused with three-awned goat grass (*Aegilops neglecta*) and is also similar to jointed goat grass (*Aegilops cylindrica*), both closely related species. In barb goatgrass, the spiklets towards the tip of the inflorescence are > 7 mm; they're shorter in *A. neglecta* (in the grass family, a spikelet is analagous to an individual flower). *Barb oatgrass lemmas have 2-3 teeth; one tooth may be awned < 1 cm. Glumes of fertile lemmas have 2-3 awns* (Baldwin et al 2012).

Grass family

Wild oats *Avena* species

©2009 Thomas stoughton

Avena fatua

©2001 Steve Thorsted

Avena barbata

HABIT Annuals. The oat species are generally < 5.5 ft tall. Elevation < 2,400 m (7,874 ft).

ORIGIN, DISTRIBUTION, AND ECOLOGY **Slender wild oat** (*Avena barbata*) and **wild oat** (*Avena fatua*) are both native to Eurasia. These species were established in CA by the 18th century. Both are abundant throughout most of western CA, but they're largely absent from desert regions and from far NorCA. Like the brome species, wild oats occur in grasslands, coastal sage scrub, chaparral, and disturbed sites.

IDENTIFICATION NOTES Four species of wild oat occur in CA; *A. barbata* and *A. fatua* are problematic in wildlands. A. barbata *has a bristle-tipped lemma with teeth that are 2-6 mm long;* A. fatua *has a lemma with a ragged tip and teeth that are less than or equal to 1.5 mm long* (Baldwin et al 2012).

Myrtle family

Tasmanian Blue Gum *Eucalyptus globulus*

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HABIT Evergreen tree up to 230 ft tall. The smooth bark is multi-colored and sheds in strips. Elevation < 300 m (984 ft).

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LEAVES (mature) are sickle-shaped, alternate, and 10-30 cm long. Leaves are aromatic. The woody **FRUITS** house small seeds.

ORIGIN, DISTRIBUTION AND ECOLOGY Tasmanian blue gum is native to Australia and Tasmania. It was introduced to the U.S. as a landscaping and windbreak tree and is also cultivated for lumber, essential oils, and pulpwood. It's a common ornamental in San Bernardino and Riverside. Tasmanian blue gum grows in disturbed riparian and coastal areas. Because of these volatile compounds present in the leaves, and because its bark hangs in strips, fire is easily carried to the crown of the tree. Blue gum sprouts prolifically from its base after being burned.

Rose family

Himalayan blackberry *Rubus armeniacus*

©2008 Keir Morse

HABIT Perennial shrub up to 10 ft tall. The angled, prickly stems are called "canes". Elevation < 1,600 m (5,249 ft).

ORIGIN AND DISTRIBUTION Himalayan blackberry is native to western Europe, and was introduced to CA for cultivation. It is common throughout CA and occurs sporadically in the foothills of the Transverse and Peninsular Ranges.

ECOLOGY AND LIFE HISTORY Himalayan blackberry grows quickly in moist open sites, roadsides, fencerows, fields, canal and ditch banks, and riparian areas. It forms dense thickets that can be difficult to pass through, and the accumulation of dead canes can be a fire hazard. Himalayan blackberry often grows near waterways, and seeds can be dispersed long distances by water. Seeds are also dispersed by animals and birds. New plants can form where the canes touch the ground.

NOTES The fungal rust *Phragmidium violaceum* was discovered in Oregon in 2004 and could effectively control Himalayan blackberry. However, the rust could potentially affect other blackberry species that are grown commercially, as well as native blackberries.

Bromus species (continued)

Ripgut brome *Bromus diandrus*

©2013 Jean Pawek

HABIT Annual. Ripgut brome can be from 0.5-4 ft tall. Elevation < 2,170 m (7,120 ft). In flower, inflorescences are erect; they droop as seeds mature. Ripgut brome has much longer awns (3-6.5 cm) than cheatgrass. *Awns* are bristle-like elongations of the grass flower parts. These awns stick to clothing and animal fur.

DISTRIBUTION Ripgut brome is largely absent from desert regions in CA, and from a few other areas, but it's present throughout the rest of the state and is abundant in the SoCA mountains. In SoCA, it is often dominant in type-converted shrublands and degraded oak woodland.

SIMILAR SPECIES Of the 37 brome taxa (including varieties and subspecies) found in CA, 27 occur in the SoCA mountains. Of those, 13 are native. The three brome species profiled (cheatgrass, ripgut brome, and smooth brome) here are all invasive and are very distinctive.

Bromus species (continued)

Red brome *Bromus madritensis* subsp. *rubens*

2014 Mary Crawford

Red brome dominates this Mojave Desert landscape.

John M. Randall

2014 Mary Crawford

HABIT Winter annual. Red brome is generally < 1.5 ft tall. Elevation < 3,050 m (10,000 ft).

DISTRIBUTION AND ECOLOGY Red brome is absent or infrequent in the far southeastern Sonoran Desert, parts of the Central Valley and Sierra Nevadas, and some of NorCA, but occurs throughout the rest of the state. Red brome is invasive throughout the desert regions of the southwest, and its presence in the Mojave Desert has changed wildfire frequency, intensity and extent. The presence of red brome also negatively affects native desert annuals. Extend drought can help control populations: red brome seeds remain viable for only 2-3 years.

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LEAVES are compound, with 3-5 leaflets, and have white undersides. **STEMS** are strongly angled.

©2013 Evan McVarish-Koch

FLOWERS (May-Sept.) are white with 5 petals.

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FRUITS are red when immature.

SIMILAR SPECIES **Pennsylvania blackberry** (*R. pensilvanicus,* non-native*)* is a close look-alike, but its leaves have grey undersides. **Pacific blackberry** (*R. ursinus*) has smaller leaves and has round stems.

2014 Adrienne Simmons

Joseph DiTomaso

Pennsylvania blackberry

©2009 Zoya Akulova

Pacific blackberry, NATIVE

Simarouba family

Tree-of-heaven *Ailanthus altissima*

©2009 Thomas Stoughton

HABIT Deciduous tree up to 80 ft tall. Young trees have smooth grey-brown bark. Mature trees have rough, cracked bark. The leaves have a skunky smell. Elevation < 1,860 m (6,102 ft).

ORIGIN AND DISTRIBUTION Tree-of-heaven is native to China and was introduced to the U.S. in 1784 as an ornamental. It was used medicinally by Chinese immigrants. In CA it is found in most mountain ranges and in central CA. It is common in the South Coast and the Peninsular Ranges.

ECOLOGY Tree-of-heaven grows quickly in many environments. It is tolerant of pollution, insects, and poor soils. It can be found on roadsides, grasslands, forests, and riparian areas. Its leaf litter may inhibit the growth of native tree species.

LIFE HISTORY Tree-of-heaven has winged seeds that are spread by wind. Seed production is prolific. Tree-of-heaven also sprouts from its roots, and creates dense thickets that crowd out native vegetation.

Bromus species

Cheatgrass *Bromus tectorum*

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HABIT Winter annual. Cheatgrass can be from 5-40 cm tall. Elevation < 3,400 m (11,155 ft). The inflorescences are open and drooping. Dried stems persist into winter.

ORIGIN AND DISTRIBUTION Cheatgrass is native to southern Europe, North Africa, and southwest Asia. The brome species were introduced to the intermountain west sometime in the mid- to late- 19th century; cheatgrass was spread by livestock and mixed in grain and discarded straw. Cheatgrass is common in most parts of the SoCA mountains and is spreading in the Peninsular Ranges.

ECOLOGY AND LIFE HISTORY Cheatgrass is a successful competitor - extensive stands of cheatgrass can outcompete native perennial grasses. Cheatgrass is an important forage species, but besides being undesirable in many ecosystems, it is a problematic weed in cropland and can reduce yields. Most cheatgrass seeds seem to be viable for only one year; however, in some cases, they've been found to be viable after 3 or even 5 years of burial. Multi-year drought, which inhibits seed germination, might help to control populations.

Grass family Annual grasses

2014 Mary Crawford

2014 Mary Crawford

ECOLOGY Pages 117-122 profile five European annual grasses that are widespread in SoCA. These annuals have similar life history traits, and have been shown to impact CA ecosystems in similar ways, mainly by changing fire regimes. Annual grasses flower in spring and typically set seed by early summer. Stems persist into fall and even winter, creating a continuous bed of fine fuels over large areas. This layer of "flash fuels" allows fires to spread quickly and to burn large areas uniformly. Ecosystems of the west which once burned infrequently, such as the Mojave Desert, are now experiencing more frequent fire return intervals because of annual grass invasions. Fire in chaparral and coastal sage scrub ecosystems has also become more frequent. In many cases, the result of this grass-fire cycle is eventual conversion of a desert or shrub ecosystem to non-native annual grassland; native shrubs do not have time to regenerate before the next fire burns an area.

MANAGEMENT Options for managing many non-native annual grass species are limited thus far, although mowing and precisely-timed burns have been very effective in controlling populations of Medusahead grass.

©2009 Thomas Stoughton

LEAVES are alternate, compound, and 2-6 ft long. Leaves have 10-22 pairs of leaflets and one leaflet at the tip.

©2010 Barry Breckling

FLOWERS (May-July) are 2-3 mm long, five-petaled, and white -yellow. The pollen is a possible allergen.

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FRUITS are < 5 cm long.

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Winter appearance

SIMILAR SPECIES Leaves of the **California black walnut** (*Juglans californica*) look similar to those of tree-of-heaven. However, the leaflets of California black walnut are finely toothed. Except for a few large, rounded teeth at their bases, the leaflets of black walnut have smooth edges.

©2011 Robert Hamilton

California black walnut, NATIVE

Spurge family

Castor bean *Ricinus communis*

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LEAVES are 10-50 cm wide. They have an unpleasant odor and can cause dermatitis.

HABIT Perennial shrub up to 10 ft tall with red-tinged stems. Elevation < 1,372 m (4,500 ft).

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The female flowers are above; male flowers are also produced.

FRUITS are spiny capsules. **SEEDS** are **highly toxic**.

ORIGIN AND DISTRIBUTION Castor bean is native to tropical Africa and Eurasia. It was introduced for castor oil production and as an ornamental. In CA it is most common in the Peninsular Ranges and on the South Coast. It also occurs in the foothills of the Transverse Ranges.

ECOLOGY Castor bean grows on disturbed sites and wet riparian areas. It's drought tolerant but grows better where there is abundant moisture.

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INFLORESCENCES (Jan.-Nov.) are purple-red, slightly drooping, and 8-20 cm long. They look like fluffy fox tails. **LEAVES** are flat or slightly folded down the middle. They're up to 2 ft long, and 2-4 mm wide.

SIMILAR SPECIES **Buffelgrass** (*Pennisetum ciliare*, non-native) is about the same size as crimson fountain grass. The flower spikes are shorter (2-13 cm long) and more slender (1-2.6 cm wide).

©2013 Keir Morse

Grass family

Crimson fountain grass *Pennisetum setaceum*

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HABIT Perennial, tufted grass up to 5 ft tall. Elevation range is at least up to 1,160 m (3,805 ft), and probably higher.

ORIGIN AND DISTRIBUTION Crimson fountain grass is native to northeastern Africa and western Asia. It was introduced for use in landscaping. In CA, it is most common on the South Coast and in the Peninsular Ranges, where it's considered to be spreading. It also grows on the cismontane foothills of the Transverse Ranges.

ECOLOGY AND LIFE HISTORY Crimson fountain grass grows on roadsides and in urban places, and also in canyons and shrublands. It is tolerate of drought and some shade, but doesn't grow well in long periods of freezing temperatures. Crimson fountain grass adapted to tolerate periodic fire. Some horticultural varieties of crimson fountain grass are sterile, but fertile varieties reproduce from seed. The bristly seeds can cling to animal fur and catch the wind.

Spurge family

Tree spurge *Euphorbia dendroides*

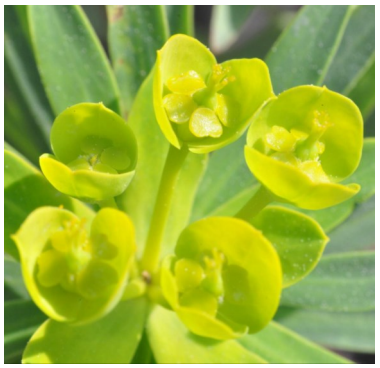
©2013 Evan McVarish-Koch

©2013 Evan McVarish-Koch

HABIT Perennial shrub up to 6.5 ft tall. Elevation at least up to 2,133 m (7,000 ft).

LEAVES are 4-8 cm long and have a linear or elliptical shape.

©2013 Evan McVarish-Koch



©2013 Evan McVarish-Koch

The yellow, leaf-like structures growing below the flowers are called *bracts*. Flowers and bracts are arranged in whorls at the branch tips.

ORIGIN AND DISTRIBUTION This Mediterranean native was introduced to CA as an ornamental. It's been collected only from the cismontane foothills of the San Gabriel Mtns. and Western Transverse ranges, and relatively few populations have been documented. Tree spurge grows in chaparral and coastal sage scrub. Since it currently has such a limited range in CA, it hasn't been assigned a CAL-IPC rating. However, it's a concern on the Angeles NF.

Tamarisk family

Tamarisk, salt cedar *Tamarix* species

ORIGIN AND DISTRIBUTION Five species of tamarisk occur in California; none are native. *T. ramosissima*, *T. chinensis*, and their hybrid are the most widespread in the southwest, and are often collectively referred to as "tamarisk" or "saltcedar". *Tamarix* species were introduced to the U.S. by nurserymen beginning in the early 19th century. They were sold as ornamentals, planted as windbreaks, and used to stabilize stream banks. By about 1930, larger stands of tamarisk were being reported in the southwest U.S.

ECOLOGY Tamarisk grows in riparian areas and floodplains. In the So-CA mountains, it can be found in perennial and intermittent creeks and along the banks of playas and reservoirs. Tamarisk can establish in relatively isolated or un-impacted habitats. However, in many of the riparian systems where it is most abundant, flow regimes have been dramatically altered by dams and water diversion. Compared with native cottonwoods and willows, tamarisk is more tolerant of the saline and xeric (dry) conditions created by these disturbances. Since tamarisk can grow in saline conditions, it may have colonized areas too saline for many native species, or areas already dominated by salt-tolerant native vegetation. *Tamarix* species root deeply in order to reach the water table. This trait helps tamarisk survive drought. Under drought conditions, tamarisk may also lose its leaves in order to conserve water.

LIFE HISTORY A mature tamarisk may produce 500,000 seeds a year, which are dispersed by wind and water. The minute, windborne seeds are short-lived (about 5 weeks, under normal conditions), but can germinate very quickly in moist, open areas. At lower elevations, tamarisk may flower throughout the growing season.

NOTES The Asian saltcedar leaf beetle (*Diorhabda elongata*) has been released in parts of the western U.S. as a biological control, and effectively defoliates tamarisk. However, in areas with extensive stands of tamarisk, defoliation may present additional complications. Over time, the death of large stands of tamarisk without revegetation could result in increased erosion. There is also concern that native vegetation may have difficulty re-establishing in many areas formerly dominated by tamarisk.

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HABIT Large grass up to 13 ft tall, with a rounded, fountain-like appearance and erect inflorescences. Elevation < 1,341 m (4,400 ft). **LEAVES** are arching and have sharply toothed edges.

SIMILAR SPECIES **Jubata grass** (*Cortaderia jubata*) is the only other *Cortaderia* species in CA. It is smaller than pampas grass, and the inflorescence extends much higher above the tops of the leaves. It is common along the coast. **Ravenna grass** (*Saccharum ravennae*) has cauline leaves. It's found in the Sonoran Desert and the Sacramento Valley.

©2008 Neal Kramer

Jubata grass, INVASIVE

The Nature Conservancy

Ravenna grass, INVASIVE

Grass family

Pampas grass *Cortaderia selloana*

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ORIGIN AND DISTRIBUTION Pampas grass is native to South America and was introduced to CA as an ornamental in the late 1800s. Scattered locations of pampas grass have been found throughout CA, but it's most common in the South Coast and in central CA. It's spreading in the western Peninsular Ranges, and also occurs in the cismontane foothills of the Transverse Ranges.

ECOLOGY Pampas grass crowds out native vegetation and competes with tree seedlings. It can be found in a variety of habitats, including chaparral, grassland, dune scrub, and seasonal wetlands. It is also found on roadsides. Pampas grass is drought and heat tolerant. The accumulation of dried leaves and inflorescences can pose a fire hazard.

LIFE HISTORY The seeds are light and catch the wind well and can travel up to 20 miles. Plumes from the previous year can stay standing for over a year and can contain up to 100,000 seeds.

Tamarix ramosissima **Saltcedar**
Tamarix chinensis **Fivestamen tamarisk**
Tamarix gallica **French tamarisk**
Tamarix parviflora **Smallflower tamarisk**

© 2014 Mary Crawford

HABIT Elevation at least up to 2,049 m (6,722 ft). Many-branched tree or shrub. Tamarisk are generally upright; the one in this picture happens to be drooping over the stream. The bark is smooth and red.

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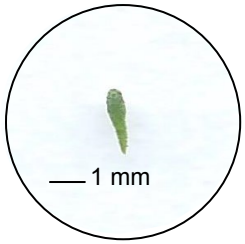
FLOWERS are small, white to pink, and densely arranged. Saltcedar and fivestamen tamarisk are extremely similar and often hybridize, and so it can be very difficult to distinguish them. The minute **SEEDS** (above, right) have hairs attached.

LEAVES are green or grey-green and scale-like. Salt glands are present on the leaves. Leaves may turn yellow or orange in the fall, or in dry years. A tamarisk twig is pictured above; one of the tiny, awl-like leaves is at right.



Tamarix aphylla **Athel**

2014 Adrienne Simmons

2014 Adrienne Simmons

Athel is the only tamarisk species that can be identified by its leaves alone; they are completely united around the stem. It grows as a larger tree (up to 40 ft tall) compared with the other tamarisk species. Although athel has been widely planted as an ornamental and windbreak tree, it doesn't spread aggressively beyond these areas. In CA, athel has been found at elevations up to around 1,100 m (3,608 ft).

©2009 John Dittes

John Randall

HABIT Perennial. Elevation < 1,500 m (4,900 ft.) Mature stems are generally > 5 ft. tall. Rhizomes (above, left) are thick. **LEAVES** are attached directly to the stem, and are < 3.3 ft long.

©208 John Dittes

Giant reed may grow rapidly by layering (above).

Rebekah Wallace

Viable seed production has not been confirmed in CA.

SIMILAR SPECIES **Common reed** (*Phragmites australis*, not pictured) is a large-stature grass that is very similar to giant reed. Two subspecies of *P. australis* (subsp. *americana* and subsp. *berlandieri*) are native to CA. The non-native subspecies *australis* has not been discovered in CA. It is a serious problem in brackish tidal zones and wetlands in the eastern U.S.

Grass family

Giant reed *Arundo donax*

James H. Miller

ORIGIN The exact origins of giant reed are uncertain, perhaps because the species has been cultivated throughout Asia, North Africa, the Middle East, and southern Europe for thousands of years. Giant reed was introduced to CA in the 1820s. It was planted along riverbanks for erosion control and bank stabilization, used as roofing material, and cultivated for horticultural. Giant reed occurs throughout southwestern CA.

ECOLOGY In CA, giant reed is especially a concern in moderate to large river channels, where it forms dense monocultures that can reduce native plant species richness. By increasing the fuel load of riparian ecosystems, giant reed may alter fire regimes in those habitats.

LIFE HISTORY However, giant reed grows and reproduces asexually by three mechanisms. 1. Rhizomes (thick, elongate, underground stems) increase the within-stand density of giant reed. 2. Fragmentation: disturbance can cause pieces of giant reed—stems, branches, or rhizomes—to break off and establish elsewhere. 3. In a process called layering, the tall stems of giant reed tip over and establish new vegetative shoots where they contact the ground.

SIMILAR SPECIES Some shrub species with reduced leaves could appear superficially similar to tamarisk.

Iodine bush (*Allenrolfea occidentalis*, native) is a shrub with tiny, alternate leaves. Its stems are fleshy, succulent, and jointed. It grows in saline environments in the Mojave and Sonoran Deserts, but it isn't known from the SoCA mountains.

©2009 Neal Kramer

Scale broom (*Lepidospartum squamatum*, native) can be found in similar habitats as tamarisk, such as dry washes. In bloom, it couldn't be mistaken for tamarisk; it's part of the sunflower family with bright yellow flowers. It's leaves grow on stiff stems, (below) and it's less than 10 ft. tall.

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Chamise (*Adenostoma fasciculatum*, native) is a tall shrub with an inflorescence of white flowers. It's a dominant component of chapparal throughout CA. The thick leaves grow in clusters.

2014 Mary Crawford

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Ginseng family

English and Algerian ivy *Hedera* species

These two ivy species are very similar. **Algerian ivy** (*Hedera canariensis*) has yellow-green stems, and its adult form is more shrubby. **English ivy** (*Hedera helix*) has mottled purple stems.

2014 Adrienne Simmons

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HABIT Perennial vine. Stems of English ivy may be as long as 100 ft. Elevation < 1,280 m (4,199 ft).

ORIGIN AND DISTRIBUTION Both *Hedera* species are native to Europe. In CA, they're found in coastal regions, and also in the Sierra Nevadas and the Central Valley. So far they occur only sporadically in the Transverse and Peninsular Ranges, but they're spreading in some areas.

ECOLOGY AND LIFE HISTORY These evergreen ivy species grow best in sunny areas; they are often found in deciduous trees because there is more sunlight available during winter months. Ivy occurs in disturbed forests, near homes, and in riparian areas, but needs moisture year-round. Ivy smothers native shrubs and trees. Because of the extra weight, the trees it grows on are more likely to be damaged by wind. During the juvenile stage, ivy reproduces vegetatively by stem fragments. Fruits are produced during the adult stage. Ivy flowers in fall and produces fruits the next spring. The stems sometimes develop aerial rootlets.

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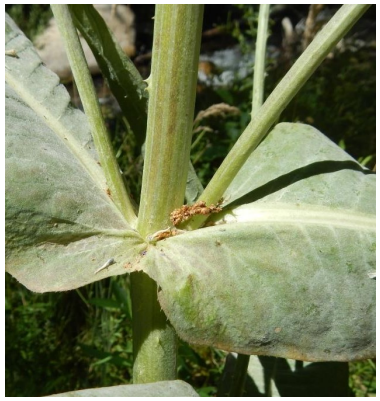
2014 Adrienne Simmons

FLOWERS (May-Aug.) are tiny, purple, and densely packed together. Long, prickly, upward-curving spines grow beneath the flower head.

Joseph DiTomaso



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LEAVES are opposite, up to 50 cm long, and fused at the bases.

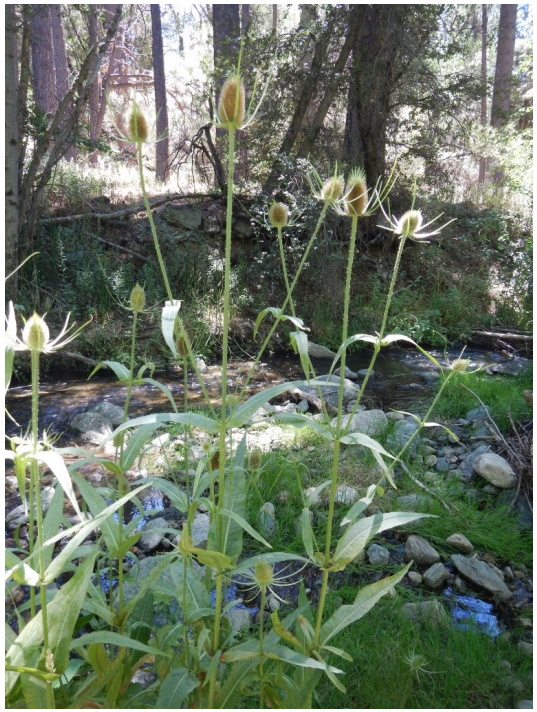
SIMILAR SPECIES **Common teasel** (*Dipsacus fullonum*) is similar to Fuller's teasel, but its stem leaves are **not** strongly fused at the bases. It's been found at a few lower elevation sites in the Peninsular and Western Transverse Ranges, but is more common in NorCA. Common teasel has a CAL-IPC rating of "Moderate".

©2003 George Hartwell

Common teasel, INVASIVE

Teasel family

Fuller's Teasel *Dipsacus sativus*



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HABIT Prickly biennials up to 6.5 ft tall. Elevation < 1773 m (5,817 ft). Stems and undersides of leaves are covered with prickles.

ORIGIN AND DISTRIBUTION Fuller's teasel is native to Europe. In CA it is found sporadically in coastal regions, the San Bernardino Mtns., and the Peninsular Ranges.

ECOLOGY Fuller's teasel grows in riparian areas, fields, and disturbed places. Dense stands of teasel can be very difficult for people and animals to walk through. Fuller's teasel has a deep taproot.

LIFE HISTORY Seeds can remain viable in the soil for up to six years. The dead stems and inflorescences can remain standing for over a year.

NOTES The spiny flower heads were once used for combing wool.

2014 Adrienne Simmons

Adult leaves

2014 Adrienne Simmons

Juvenile leaves

LEAVES are alternate, evergreen, glossy, and leathery. Juvenile leaves have 3-5 lobes and are up to 35 cm long. Adult leaves are diamond-shaped, have 3 lobes, and are 15 cm long.

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FRUITS are blue-black, 5 mm in diameter, and are **toxic**.

©2009 Phill Pullen

FLOWERS (Aug.-Nov.) are white to yellow-green and have five petals.

Legume family

Perennial sweet pea *Lathyrus latifolius*

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HABIT Twining or sprawling vine. Elevation < 2,133 m (7,000 ft).
LEAVES are compound, and so what look like individual leaves are actually two leaflets. Petioles are *winged*, which means that a band of tissue runs along each side of the petiole. This gives the stems and petioles a flattened appearance.

ORIGIN AND DISTRIBUTION Perennial sweet pea is native to southern Europe. It's an ornamental that has escaped from cultivation. It occurs throughout SoCA, in the Sierra Nevadas and in the San Francisco Bay area.

ECOLOGY Perennial sweet pea grows in creeks and riparian zones, and has also been observed in drier woodlands. It often occurs near homesteads or in areas where it's been planted. At this point, it's not aggressively invading wildlands. However, it's a concern because it seems to be spreading in some areas.

NOTES There are 38 other species or varieties of *Lathyrus* in CA; 29 are native.

Sunflower family

Common dandelion *Taraxacum officinale*

2014 Mary Crawford

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The pictures above are of common dandelion. Common dandelion occurs throughout NA as a weed of lawns, roadsides, and disturbed areas. It's widely naturalized, and doesn't out-compete or exclude native species. However, in the San Bernardino Mtns., common dandelion is a concern because it hybridizes with the endangered California dandelion. This changes the genetics of California dandelion populations. Compared with California dandelion, common dandelion has more deeply lobed and divided leaves, and downward-curving phyllaries (above, right).

SIMILAR SPECIES The federally endangered California dandelion (*Taraxacum californicum*) grows in meadows in the San Bernardino Mtns. California dandelion has leaves that are at most shallowly toothed or lobed, and phyllaries that point upward (below, left, definition pg. 89).

Scott Eliason

Scott Eliason

Sunflower family

Bristly ox-tongue *Helminthotheca echioides*

Joseph DiTomaso

©2012 Richard Spellenberg

HABIT Annual or biennial. Elevation < 1,050 m (3,445 ft.)

©2010 Zoya Akulova

Joseph DiTomaso

LEAVES are both basal and cauline. The leaves are alternately arranged, and have scattered prickles.

ORIGIN AND DISTRIBUTION Bristly ox-tongue is native to Europe. It occurs throughout western CA, but is largely absent from the desert regions, the Sierra Nevadas, and the Great Basin.

ECOLOGY AND LIFE HISTORY Bristly ox-tongue may grow as a winter or summer annual, or as a biennial. It's generally found in disturbed, open, seasonally wet areas. These may include roadsides, fields, and pastures. Although bristly ox-tongue is a common weed, at this point, it's not aggressively invading wildlands.

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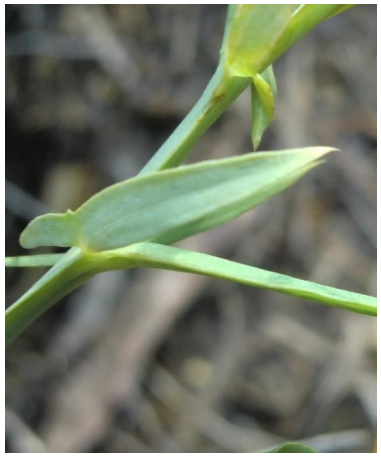
TENDRILS are often present at the bases of the leaves.



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The leaf-like appendages at the base of each petiole are called *stipules*.

Emma Williams

FLOWERS are pink or purple-pink and are 2-3 cm wide. Inflorescences have 4-15 flowers.

2014 Mary Crawford

FRUITS are legumes. The seeds are **toxic**.

SIMILAR SPECIES Perennial sweet pea is most similar to another species of non-native wild pea, **Tangier pea** (*L. tingitanus*). However, Tangier pea has inflorescences with only a few flowers. The native **San Diego pea** (*Lathyrus vestitus* var. *alefeldii*) has showy pink flowers, but its leaves have > 2 leaflets.

Sunflower family

German ivy *Delairea odorata*

©2007 Neal Kramer

HABIT Perennial vine with stems up to 20 ft. Elevation < 1,500 m (4,921 ft).

ORIGIN AND DISTRIBUTION This ivy (also known as cape ivy) is native to South Africa, where it grows at high elevations in fog forests. It was brought to CA as an ornamental in the late 1800s. In CA it is largely confined to coastal regions, but it is spreading in foothills of the Peninsular and Transverse Ranges. Populations in the San Francisco Bay Area have doubled in the last 10 years.

ECOLOGY AND LIFE HISTORY German ivy covers and chokes native species and can reduce native seedling recruitment. This ivy grows in areas where there is year-round moisture. Besides occurring in disturbed areas and near homesteads, it can also be found in grasslands, open forests, and seasonal wetlands. New plants can sprout from fragments of roots, stolons, and stems. These fragments detach readily. Fragments root easily and can remain viable for weeks in inhospitable environments. German ivy hasn't been found to produce viable seed in CA.

Sunflower family

Crown daisy *Glebionis coronaria*

©2005 Luigi Rignanese

©2012 Zoya Akulova

HABIT Annual. Elevation < 1,000 m (3,281 ft) **LEAVES** are toothed and dissected. Unlike many species in the sunflower family, the seeds of crown daisy have no pappus.

©2005 Luigi Rignanese

©2006 Luigi Rignanese

FLOWERS may have white or yellow rays.

ORIGIN, DISTRIBUTION AND ECOLOGY This Mediterranean native is problematic at lower elevations in the Peninsular Ranges and along the SoCA coast, where it can form dense, monotypic stands. It's been collected from roadsides and waste places, and has also been discovered in marshes (some saline) and canyons. Crown daisy was formerly considered a species of *Chrysanthemum.*

Sunflower family

Blessed thistle *Centaurea benedicta*

2014 Mary Crawford

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HABIT Annual. Elevation < 1,700 m (5,577 ft). **LEAVES** are coarsely toothed and resin-dotted. They are 10-20 cm long, and the teeth may be spine-tipped.

2014 Mary Crawford

2006 Chris Wagner/SBNF

FLOWERS have no stalk and are nestled within the leaves and bracts.

ORIGIN AND DISTRIBUTION Blessed thistle (formerly placed in the genus *Cnicus*) is native to Europe. This thistle has been collected from lower elevations throughout the Transverse and Peninsular Ranges, and in the South Coast region. Blessed thistle is considered naturalized in CA. This species can be found in disturbed areas and waste places, and also grows in washes.

©2007 Neal Kramer

©2009 Thomas Stoughton

©2007 Neal Kramer

LEAVES are evergreen, alternate, and glossy. They have 5-9 lobes with pointed tips. **FLOWERS** (Sept.- Mar.) are yellow and clustered.

SIMILAR SPECIES **Wild cucumber** (*Marah* species) and **wild grape** (*Vitis* species) are native vines with leaves similar to those of German ivy. However, they have very different flowers and fruits. **English and Algerian ivy** (pgs. 38-39) could also be confused with German ivy.

2006 Chris WagnerSBNF

Wild cucumber, NATIVE

2009 Julie Nelson

Wild grape, NATIVE

Asphodel family

Onionweed, asphodel *Asphodelus fistulosus*

©2005 Luigi Rignanese

USDA APHIS PPQ Archive

©2007 Luigi Rignanese

LEAVES are numerous, erect, cylindrical, and hollow. They are 15-40 cm long. The leaves have no onion odor.

HABIT Annual, short-lived perennial. Elevation < 800 m (2,624 ft.) **FLOWERS** have 6 petals and are white with a brown midvein.

ORIGIN, DISTRIBUTION AND ECOLOGY Onionweed is native to southern Europe and the Mediterranean. It seems to have been planted primarily as an ornamental. Onionweed is established and spreading along the CA coast from San Diego north to San Luis Obispo, and it's been found on the cismontane slopes of the SoCA mountains. In CA, onionweed occurs along roadsides, on coastal dunes, and in agricultural lands. It colonizes disturbed places, especially those with sparse vegetation.

2014 Adrienne Simmons

2014 Adrienne Simmons

FLOWERS (May-Sept.) are yellow. The spines growing below the flowers are 10-25 mm long and straw-colored. **STEMS** are winged.

©2008 Zoya Akulova

©2008 Zoya Akulova

LEAVES are covered with white, cobwebby hairs and appear grey-green. Leaves are both basal and cauline. (Only basal leaves are pictured above.)

SEEDS are smooth and may or may not have a *pappus* (the light, feathery bristles at the end of the seed which aid in wind dispersal).

SIMILAR SPECIES Tocalote (*Centaurea melitensis*, pgs. 90-91) could be confused with yellow star-thistle; the species are distinguished by phyllary (definition pg. 89) spine color and length.

Sunflower family

Yellow star-thistle *Centaurea solstitialis*

2014 Adrienne Simmons

HABIT Annual up to 6 ft tall. Elevation < 1,330 m (4,265 ft).

ORIGIN AND DISTRIBUTION Yellow star-thistle is native to southern Europe. It was introduced to CA in the 1850s, as a contaminate in bulk seed and ballast. Yellow star-thistle is found on more than 4.8 million hectares throughout CA. It's largely absent from desert regions.

ECOLOGY Yellow star-thistle occurs on roadsides, grasslands, waste places, agricultural fields, and open woodlands. Some areas invaded by yellow star-thistle have reduced native plant diversity. It is also very deeply rooted, and infestations of yellow star-thistle have been shown to alter soil water dynamics. Because of its deep taproot, and because it remains alive all summer, plant communities dominated by yellow star thistle can have lower soil water content compared with grasslands. Yellow star-thistle is problematic in rangelands, where it lowers forage quality and interferes with grazing.

LIFE HISTORY Yellow star-thistle seeds can remain viable in the soil for up to 10 years and can survive high temperatures (575° F). The seeds are wind-dispersed. Dead plants persist throughout the winter.

NOTES The foliage can cause lethal chewing disease in horses if it is consumed for a long period of time.

Buttercup family

Bur buttercup *Ranunculus testiculatus*

2014 Adrienne Simmons

HABIT Annual up to 10 cm. Elevation < 2,300 m (7,545 ft).

2014 Adrienne Simmons

LEAVES are linear and dissected. They're < 3.8 cm long.

2014 Adrienne Simmons

FRUITS have a bur-like appearance.

2014 Adrienne Simmons

FLOWERS (Apr.-May) are 1-2 mm wide and have 5 petals.

ORIGIN, DISTRIBUTION AND ECOLOGY This tiny buttercup was first collected in Utah in 1932. It hasn't been documented from coastal regions, but is spreading in arid and semiarid areas. Bur buttercup is found in grasslands, sagebrush shrubland, and pinyon/juniper woodland. It is also grows in disturbed areas and along trails. Severe infestations can carpet sites. Bur buttercup reproduces by seed.

Caltrop family

Puncture vine *Tribulus terrestris*

©2009 Thomas Stoughton

FLOWERS (Mar.-Oct.) are 5 mm wide and have 5 petals.

©2009 Thomas Stoughton

SEEDS are spiny and easily stick to clothing and fur.

©2001 Steven Thorsted

HABIT Flat, creeping annual. Elevation < 1,000 m (3,280 ft).
LEAVES are compound, with 3-7 leaflets per leaf.

ORIGIN, DISTRIBUTION, AND ECOLOGY Puncture vine is native to the Mediterranean region. It was likely accidently introduced; its existence in CA was first noted in 1903. It occurs throughout CA, and is most common in the southwest along roadsides and in waste places. Dense populations can be up to a foot deep. Puncture vine is killed by freezing temperatures. Puncture vine has been controlled by the introduction of two weevil species, which feed on its the stems and seeds.

2006 J. Zylstra

2006 J. Zylstra

FLOWERS (Apr.-June) are yellow. The base of each flower head has purple-red spines that are 5-10 mm long.

2006 J. Zylstra

Tocalote in winter.

© 2007 Thomas Stoughton

STEMS are winged.

SIMILAR SPECIES No species of *Centaurea* are native to CA. Of the 10 non-native *Centaurea*, four have yellow flowers. In SoCA, tocalote is most likely to be confused with **yellow star-thistle** (pgs. 92-93). **Sicilian star-thistle** (*Centaurea sulphurea*) also looks very similar, but is found only in NorCA. **Blessed thistle** (pg. 94) also occurs in SoCA.

©2001 CDFA

Sicilian star-thistle, NON-NATIVE

Sunflower family

Tocalote *Centaurea melitensis*

©2007 Thomas Stoughton

HABIT Annual with wiry stems, up to 3 ft tall. Elevation < 2,200 m (7,217 ft). **LEAVES** green and covered with white cobwebby hairs, which make them appear grey-green. Leaves are both basal and cauline.

ORIGIN AND DISTRIBUTION Tocalote is native to southern Europe and was introduced to CA in the late 1700s, as a contaminate in bulk seed. Tocalote is common in the Transverse and Peninsular Ranges and in the South Coast region.

ECOLOGY AND LIFE HISTORY Tocalote can be found on roadsides, grasslands, waste places, agricultural fields, and open woodlands. Dense populations can displace native plants. Tocalote reproduces by wind-dispersed seeds.

NOTES Phyllary (definition pg. 89) spine color and length distinguishes tocalote from yellow star thistle.

Carrot family

Fennel *Foeniculum vulgare*

2014 Adrienne Simmons

2014 Adrienne Simmons

HABIT Perennial up to 10 ft tall. Elevation < 1,600 m (5,249 ft).
LEAVES are feathery, dissected, and have the distinctive smell of anise.

2014 Adrienne Simmons

2014 Adrienne Simmons

FLOWERS (Apr.-Oct.) are 1-4 cm wide and are arranged in a type of inflorescence called an *umbel*.

ORIGIN AND DISTRIBUTION Fennel is native to the Mediterranean region and used medicinally and as a spice. It is common throughout central and coastal CA.

ECOLOGY AND LIFE HISTORY Fennel is fairly shade-intolerant; it grows in open, disturbed areas. Fennel produces large numbers of seeds, and established populations easily persist. New plants can also grow from root fragments. Dead stalks remain standing into winter.

Carrot family

Poison hemlock *Conium maculatum*

Chris Evans

Robert Vidéki

HABIT Biennial. Elevation < 1,600 m (5,249 ft). **STEMS** are smooth and generally purple spotted or streaked. **LEAVES** are compound with leaflets that have toothed edges.

ORIGIN AND DISTRIBUTION Poison hemlock is native to Europe and Africa. It was introduced to the U.S. as an ornamental in the 19th century. Poison hemlock occurs throughout most of western CA (including the SoCA mountains) and is spreading in many areas. It is absent from desert regions and the Great Basin.

ECOLOGY Poison hemlock grows in riparian zones, wetlands, and generally moist areas. These may be disturbed sites such as fields and ditches. Because it is poisonous to livestock, infestations in pastures are a concern, but animals generally avoid poison hemlock.

NOTES Poison hemlock is **highly toxic** to humans and livestock when ingested. Handling poison hemlock can cause skin irritation in some people. This plant was reportedly used to poison the Greek philosopher Socrates. Water hemlock species (*Cicuta* species) are also very toxic.

SIMILAR SPECIES **Purple star-thistle** (*C. calcitrapa*) and **diffuse knapweed** (*C. diffusa*) appear similar to spotted knapweed but have different *phyllary* structure. In the sunflower family, phyllaries are the scale-like structures that enclose the flowers. The phyllaries of the two species below are tipped with spines.

Malcolm Storey

Barry Rice

Purple star-thistle, INVASIVE. In CA, collections are concentrated near San Francisco. The seeds of purple star-thistle have no pappus.

Carey Minteer

Cindy Roche

Diffuse knapweed, INVASIVE. Collections in the San Bernardino Mtns. represent the only known occurrences of diffuse knapweed in SoCA. Phyllary edges are covered with short hairs (above, right).

Spotted knapweed

Centaurea stoebe subsp. *micranthros*

Marisa Williams

Michael Shephard

HABIT Biennial or short-lived perennial. Elevation < 2,000 m (6,561 ft). **FLOWERS** are pink or purple.

Leslie Mehrhoff

Rob Routledge

LEAVES are green to grey-green and have short, stiff, resin-dotted hairs. Non-flowering individuals have rosette of basal (right) leaves. Cauline leaves are slender.

©2011 Zoya Akulova

©2011 Zoya Akulova

FLOWERS are small, white, and grouped in an umbel.

FRUITS are 2-3 mm wide.

SIMILAR SPECIES Many other species in the carrot family have compound leaves and white flowers clustered in an umbel.

2006 Chris Wagner

©2013 Debra Cook

Bur-chervil, NON-NATIVE, annual, without purple-spotted stems.

©2012 Jean Pawek

©2002 Brad Kelley

Water-hemlock, NATIVE, with linear leaflets.

Dogbane family

Big periwinkle *Vinca major*

Emma Williams

HABIT Perennial, evergreen, vine-like herb with milky sap. Elevation < 1,593 m (5,226 ft).

ORIGIN AND DISTRIBUTION Big periwinkle is native to central Europe and was introduced to the U.S. as an ornamental and medicinal herb. It's still commonly planted as an ornamental. It's present and spreading in many coastal areas, in the Transverse and Peninsular ranges, and in parts of the Central Valley.

ECOLOGY Big periwinkle grows best in moist, shady areas; these include stream banks, moist woodlands, coastal bluffs, and roadsides. It's tolerant of poor soils, spreads quickly, and can crowd out native vegetation.

LIFE HISTORY Big periwinkle reproduces vegetatively. The stems root at the tips, which helps the plant to form dense ground cover. Stem fragments can also take root. Periwinkle produces showy purple flowers, but they're generally sterile, and seeds are rarely produced.

Russian knapweed *Acroptilon repens*

©2013 Richard Spellenberg

©2013 Neal Kramer

HABIT Taprooted perennial. Elevation < 2,250 m (7,380 ft.) **LEAVES** near the top of the plant are oval or oblong, but are not lobed or divided. Basal leaves are lobed. Leaves are whitish.

©2013 Richard Spellenberg

©2013 Richard Spellenberg

FLOWERS are purple.

Sunflower family

Knapweeds *Centaurea* and *Acroptilon* species

ORIGIN AND DISTRIBUTION **Russian knapweed** is native to central Asia. It was introduced to Canada in the early 1900s in contaminated alfalfa seed, and now occurs throughout CA. **Spotted knapweed** is native to Europe. It was first collected in Canada in 1893, and is now found in most of the contiguous 48 states. In CA, it occurs in all regions except the San Joaquin Valley, the Mojave and Sonoran Deserts, and the South Coast. So far, the species isn't widespread in the SoCA mountains, but it is a major concern to land managers. Knapweed taxonomy is complex, and several knapweed species can hybridize. 17 species of *Centaurea* and one *Acroptilon* have been documented in CA; all are non-native.

ECOLOGY Knapweed can be found in grasslands and shrublands throughout the west. Deer, sheep, cattle, and goats have been observed to graze spotted knapweed at low to moderate levels, but generally knapweed is considered to reduce the forage quality of rangelands. **Spotted knapweed** is relatively shade-intolerant; although it can be found in roadsides and disturbed areas throughout much of the eastern United States, it tends not to invade heavily-forested regions. Although it sometimes forms dense monocultures, **Russian knapweed** may also occur within a mixture of native grasses and forbs. Russian knapweed might tend to become dominant on fine-textured soils.

Roots and leaves of **Russian knapweed** contain *allelopathic* chemicals, which can inhibit the germination and growth of other plant species. Russian knapweed has been shown to negatively affect other species in laboratory experiments, but allelopathic effects are difficult to demonstrate in the field.

LIFE HISTORY **Spotted knapweed** may be either a biennial (completing its life cycle in two years or growing seasons) or a perennial. One plant may produce 400-900 seeds in a growing season. Like many species in the sunflower family, spotted knapweed produces small seeds that have a light, feathery structure called a *pappus* attached. The pappus facilitates dispersal by wind, but spotted knapweed is also spread by animals, vehicles, and in crop seed.

2014 Adrienne Simmons

2014 Adrienne Simmons

LEAVES are glossy, opposite, and 7 cm long. Edges have small hairs.

2014 Adrienne Simmons

2014 Adrienne Simmons

FLOWERS (Feb.-Aug.) have 5 petals. They're 3-5 cm wide.

SIMILAR SPECIES **Common periwinkle** (*Vinca minor*, non-native) also occurs in CA, but rarely escapes cultivation. Compared with big periwinkle, it has smaller leaves (< 4 cm long) and flowers (< 2 cm wide). The leaf edges of common periwinkle are hairless. At right, the flower of big periwinkle is above; common periwinkle is below.

Barry Rice

Figwort family

Wooly mullein *Verbascum thapsus*

2010 Julie Nelson

2014 Mary Crawford

HABIT Biennial up to 6.5 ft tall. Elevation < 2,470 m (8,103 ft).

ORIGIN AND DISTRIBUTION Wooly mullein is native to Eurasia. It was likely introduced to NA in the 1700s as a medicinal herb. It occurs throughout most of CA, but is absent from the desert regions.

ECOLOGY Wooly mullein is most problematic (and visible) in sparsely vegetated or bare places. It can be found in disturbed areas like roadsides, forest clearings, and pastures. It also occurs in wetter areas, in meadows, and along creeks and streams. It can establish rapidly following forest fires.

LIFE HISTORY One wooly mullein individual can produce as many as 240,000 seeds in a growing season. Dead stalks of wooly mullein remain standing, and so the species can be identified even in winter.

2014 Mary Crawford

2014 Mary Crawford

LEAVES are covered in stiff hairs, and their lobe tips have spines.

2014 Mary Crawford

2014 Mary Crawford

FLOWER HEADS (June - Oct.) are up to 4 cm wide with prickly green bases. **SEEDS** have long, feathery bristles.

SIMILAR SPECIES Three other species of non-native *Cirsium* occur in CA. There are also many native *Cirsium*, some of which are threatened or endangered. **Cobweb thistle** (*Cirsium occidentale)* and **wavyleaf thistle** (*C. undulatum)* can both be found in the SoCA mountains.

2006 Chris Wagner/SBNF

Wavyleaf thistle, NON-NATIVE

©2001 CDFA

Cobweb thistle, NATIVE

Sunflower family

Bull Thistle *Cirsium vulgare*

2014 Mary Crawford

2014 Adrienne Simmons

HABIT Biennial up to 6.5 ft. Elevation < 2,350 m (7,709 ft).

ORIGIN AND DISTRIBUTION Bull thistle is native to Eurasia. Its seeds were probably transported to CA in agricultural seed. It hasn't been collected from desert regions, but occurs throughout the rest of CA.

ECOLOGY Bull thistle does not grow well in deep shade, but any kind of disturbance that creates bare patches of soil also creates habitat for bull thistle. It can be found in disturbed areas, fields, and pastures, but also in washes and riparian areas. In pastures and rangelands, bull thistle can displace forage species.

LIFE HISTORY Bull thistle seeds can be dispersed by wind, eaten by birds and small mammals, or moved by humans in hay and bulk seed. Dead bull thistle stalks can remain standing for up to two years.

NOTES Bull thistle also looks a bit like some of the *Carduus* species, such as Italian thistle (pgs. 78-79) and musk thistle (pgs. 80-81).

2014 Mary Crawford

2014 Adrienne Simmons

FLOWERS (May-Sept.) are yellow and densely clustered.

Dead plants and inflorescences are visible year-round.

2014 Mary Crawford

2014 Mary Crawford

LEAVES are covered dense, soft hairs. Basal leaves are 8-50 cm long; cauline leaves are 5-30 cm long and alternate.

SIMILAR SPECIES

Moth mullein (*Verbascum blattaria)* has smooth leaves, and the flowers are arranged more loosely compared with wooly mullein.

©2010 Barry Breckling

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Moth mullein, NON-NATIVE

Geranium family

Redstem filaree *Erodium cicutarium*

HABIT Annual. Elevation < 2,000 m (6,560 ft). The slender taproot of filaree can be difficult to pull.

2014 Mary Crawford

LEAVES are highly toothed and dissected.

2014 Mary Crawford

ORIGIN AND DISTRIBUTION Redstem filaree is native to the Mediterranean region, and was introduced to Baja and present-day CA by the Spanish. It is one of the earliest invasive species to western NA; analyses of pollen records have found that it was present in Baja in the 17th century.

ECOLOGY AND LIFE HISTORY Redstem filaree is common throughout CA and can be found in grasslands, deserts, and disturbed areas. Native rodents eat redstem filaree seeds. Seeds easily attach to clothing and animal fur. Filaree seeds are "self-planting" - their structure allows them to drill into the soil. Because it is so widespread, there's little that can be done to manage redstem filaree on a landscape scale.

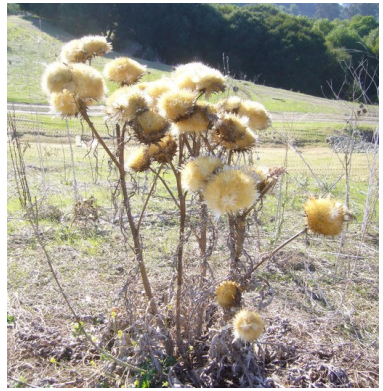
© John M. Randall

© 2001 CDFA

FLOWERS are purple. The part of the artichoke that we eat is called the receptacle; it's the structure enclosing the flowers, and it's comprised of numerous phyllaries (above, right). In cardoon and feral artichoke, the phyllaries are spine-tipped. See pg. 89 for a definition of phyllaries.

© John M. Randall

LEAVES are compound and alternate; they grow both at the base of the plant, and along the stem. The tips of the leaf lobes are spiny.


©2011 Zoya Akulova

SEEDS have a long (2-4 cm) *pappus,* making the seed heads appear fluffy. (*Pappus* is a collective term for the bristles attached to the seeds of some species in the sunflower family).

SIMILAR SPECIES The large, purple flower heads of artichoke thistle are similar to those of some *Carduus* (especially musk thistle, pgs. 80-81) and *Cirsium* species (such as bull thistle, pgs. 84-85). Artichoke thistle has compound leaves; while the leaves of musk and bull thistle are deeply lobed, they aren't compound.

Sunflower family

Cardoon, artichoke thistle *Cynara cardunculus*

©2008 Neal Kramer

HABIT Perennial. Elevation < 500 m (1,640 ft). Cardoon can be 5-6 ft. tall.

ORIGIN AND DISTRIBUTION Cardoon was introduced to CA for cultivation sometime in the 19th century. It occurs in the Peninsular Ranges and at cismontane lower elevations in the Transverse Ranges. Cardoon (also called artichoke thistle) is the same species as cultivated artichoke, but is considered a different variety (var. *sylvestris*). In many cases, cultivated artichokes that have escaped cultivation ("feral" artichokes) may be indistinguishable from cardoon; both cardoon and feral artichokes develop spines on their phyllaries, leaves, and stems.

ECOLOGY AND LIFE HISTORY In SoCA, cardoon grows in a variety of habitats. It primarily invades disturbed areas and annual grasslands, but has also been found in chaparral, riparian areas, and coastal sage scrub. In some areas cardoon forms dense monocultures. Seeds are dispersed by wind and birds, and one seed head can produce up to 600 seeds. Seedlings germinate in the fall and winter.

2014 Mary Crawford

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FLOWERS (Feb.- Aug.) have 5 petals and are pink or purple. At maturity, **FRUITS** uncoil from the base and split explosively to release their seeds; seeds may be flung up to 1.5 ft in this way.

SIMILAR SPECIES Six species of filaree occur in CA, and four (including redstem filaree) are known from the SoCA mountains. Of those, only **Texas filaree** (*E. texanum*) is native. **Greenstem filaree** (*E. moschatum*, non-native) leaves are less deeply toothed than those of redstem filaree. Other members of the geranium family have 5 petals and linear fruits, and some have pink flowers. However, no other genera have leaves as dissected as those of redstem filaree.

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Greenstem filaree (basal leaves)

©2010 Thomas Stoughton

Texas filaree, NATIVE (leaves)

Goosefoot family

Russian thistles *Salsola species*

2014 Mary Crawford

2014 Mary Crawford

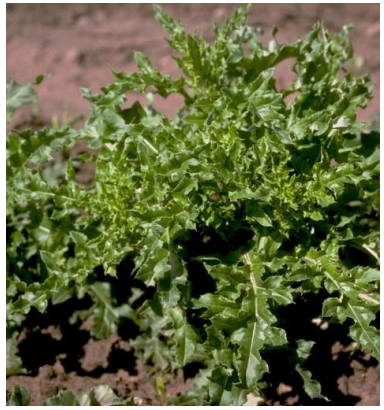
HABIT *Salsola* species are annuals. They are often highly branched. Elevation range varies depending on the species.

ORIGIN Seven species of *Salsola* occur in CA; none are native. *Salsola tragus* (also known as tumbleweed) was first reported in CA in 1893. Native to Eurasia, *S. tragus* is believed to have been introduced to the U.S. in the 1870s in contaminated agricultural seed. **Barbwire Russian thistle** (*S. paulsenii*) is also native to central Asia. The origin and introduction of the other *Salsola* species is more uncertain. *Salsola* occur throughout CA, but because they can be so challenging to identify, the ranges of the various species haven't been well mapped.

ECOLOGY Russian thistles generally grow in loose, disturbed soils. They can be found along roadsides and trails, and in croplands and pastures. Russian thistles are well-adapted to dry environments and are common throughout desert and semi-arid regions of the west.

LIFE HISTORY When mature, the stem of *S. tragus* detaches from its base and tumbles across the landscape, dispersing seed in the process. Piles of *S. tragus* can accumulate alongside fences and other structures. Not all *Salsola* species disperse using this strategy; seeds of barbwire Russian thistle simply fall from the plant. Seed production also varies by species. Individual plants of *S. tragus* have been found to produce 4, 600 to 17, 000 seeds. Rodents eat Russian thistle seed.

©2007 Thomas Stoughton



Howard F. Schwartz

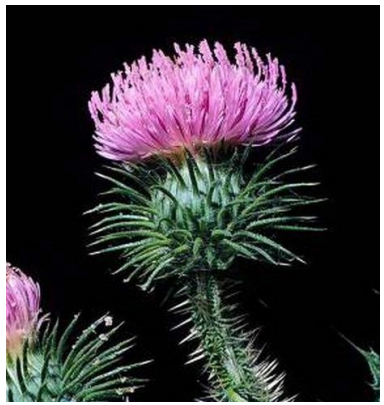
LEAVES are smooth, but the edges of the leaves and stems are spiny. Both basal and cauline leaves are present.

©2007 Thomas Stoughton

Wendy VanKyk Evans

FLOWERS (June - Sept.) are pink-purple. The flower heads are solitary and grow on long stalks.

SIMILAR SPECIES **Plumeless thistle** (*Carduus acanthoides*) can hybridize with musk thistle, but is generally found in NorCA. It has clustered flower heads. **Cardoon** (*Cynara cardunculus,* pg. 78) has much larger flower heads and leaves. Musk thistle could also be mistaken for **bull thistle** (*Cirsium vulgare*, pg. 84).



Joseph DiTomaso

Plumeless thistle, NON-NATIVE

Sunflower family

Musk thistle; Nodding thistle *Carduus nutans*

©2009 Gary Monroe

HABIT Annual/biennial, < 5 ft tall. Elevation < 2,100 m (6,889 ft).

ORIGIN AND DISTRIBUTION Musk thistle was introduced from Europe. In CA it is found in most mountain ranges and in the Mojave Desert, Modoc Plateau, and South Coast regions.

ECOLOGY AND LIFE HISTORY Fire, overgrazing, and trampling create bare patches of soil that are very good habitat for musk thistle. The decomposing leaves of musk thistle release *allelopathic* chemicals, which can inhibit the growth of other plant species. Musk thistle reproduces by seeds; seeds are dispersed by human activities, wind, and water.

NOTES Thistle head weevil (*Rhinocyllus conicus*) attacks the *Carduus* genus and some native *Cirsium* thistles. This weevil was accidently introduced to CA. It attacks inflorescence in a way that most of the seeds remain stuck inside, which causes them to rot. The musk thistle rust (*Puccinia carduorum*) has been recently found in CA and could be approved as a biocontrol agent.

2014 Mary Crawford

2014 Mary Crawford

STEMS of some species are striped. **LEAVES** are alternate, especially towards the top of the plant. Young leaves may be slender; older leaves are often thick, leathery, and spine-tipped.

©2008 Thomas Stoughton

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Flower parts may be white or pink. They remain even after the plant has fruited. Above, right: dead, tumbling stems of *Salsola* in January.

SIMILAR SPECIES Saltlover (*Halogeton glomeratus*, CAL-IPC= Moderate) occurs in arid and desert regions of CA, and can especially colonize disturbed or overgrazed sites. So far, it isn't known from the SoCA Mtns. Saltlover and *Salsola* have similar flowers, but the leaves of saltlover are cylindrical.

©2010 Steve Matson

Goosefoot family

Australian saltbush *Atriplex semibaccata*

2014 Mary Crawford

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HABIT Perennial. Australian saltbush is < 1.5 ft tall, but can be 13 ft wide. Elevation < 1,000 m (3,280 ft). **LEAVES** are alternate, covered in white scales, and up to 3.5 cm long. The older vegetation loses these scales. **FRUITS** are surrounded by 3-6 mm-long red bracts that are fleshy at maturity (above, left). **FLOWERS** (Apr.-Dec.) are very small and difficult to see.

ORIGIN AND DISTRIBUTION This perennial was introduced as livestock forage because it grows well in unfavorable conditions. It is common in the South Coast region and the cismontane foothills of the Peninsular Ranges.

ECOLOGY AND LIFE HISTORY Australian saltbush is drought-tolerant and can grow in saline and alkaline soils; it's found in shrublands and grasslands, in disturbed areas and fields, and near salt marshes. It is used to restore mining sites. This shrub is somewhat tolerant of freezing temperatures, but can be damaged by prolonged periods of cold. Australian saltbush reproduces by seeds, which are consumed by birds and small mammals.

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BASAL LEAVES are 10-15 cm long. The shorter cauline leaves extend into prickly wings. Leaves are covered in wooly hairs.

FLOWERS (May - July) are purple. The base of the flower cluster is green, spiny, and covered with wooly hairs. Flower heads are clustered in groups of 2-5.

SIMILAR SPECIES **Slenderflower thistle** (*Carduus tenuiflorus*) resembles Italian thistle, but has 5-20 flowers per cluster instead of 2-5. Slenderflower thistle is found along the CA coast. **Blessed milk thistle** (*Silybum marianum)* leaves can look similar to those of Italian thistle, but they are strongly marked with white.

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Slenderflower thistle, NON-NATIVE

©2009 Barry Breckling

Blessed milk thistle, INVASIVE

Sunflower family

Italian thistle *Carduus pycnocephalus*

©2008 Keir Morse

2014 Adrienne Simmons

HABIT Annual or biennal, < 6.5 ft tall. Elevation < 1,200 m (3,937 ft).

ORIGIN AND DISTRIBUTION Italian thistle is native to the Mediterranean. It's common throughout most of CA, although it hasn't been documented in desert regions or at higher elevations in the San Gabriel and San Bernardino Mtns. In SoCA it is common in the South Coast region and in the foothills of the Transverse Ranges. No *Carduus* species are native to CA.

ECOLOGY Italian thistle grows on bare patches of soil created by fire, overgrazing, and trampling. Livestock do not find it palatable, and so it can thrive in pastures.

LIFE HISTORY Italian thistle produces large quantities of seed, which can be dispersed by wind. The seeds can remain viable in the soil for up to seven years. Dead stalks of Italian thistle are visible into winter. A weevil that attacks the seed head is a possible biocontrol for Italian thistle (more information is on pg. 84).

Legume family

Sweetclovers *Melilotus alba, M. officinalis*

2014 Mary Crawford

2014 Mary Crawford

HABIT Elevation at least (3,280 ft). **LEAVES** are compound, with three leaflets. White and yellow sweetclover have very similar leaves.

2014 Mary Crawford

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FLOWERS of *M. alba* are white; those of *M. officinalis* are yellow. Flowers are 3-7 mm long. **FRUITS** have networks of fine lines.

DISTRIBUTION Both of these sweetclover species have been widely planted in order to revegetate disturbed areas. They are generally considered naturalized in CA, but in some areas they form dense stands.

SIMILAR SPECIES Sourclover (*Melilotus indicus*) also occurs in CA and has yellow flowers. Compared with yellow sweetclover, it has smaller flowers (only 2.5-3 mm long).

Mustard family

Saharan mustard *Brassica tournefortii*

©2004 James Andre

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ORIGIN AND DISTRIBUTION Saharan mustard is native to the deserts of North Africa and the Middle East. In CA, it seems to have first established in the Coachella Valley in the 1920s, but was uncommon for many years. The species became much more abundant in the 1970s and 80s, particularly after years with above-average rainfall. Saharan mustard now occurs throughout the Mojave and southern Sonoran deserts, and at lower elevations in the Transverse and Peninsular Ranges.

ECOLOGY In desert and cismontane ecosystems in SoCA, Saharan mustard grows on dunes, disturbed sites and roadsides. In some sand fields, Saharan mustard forms dense canopies over the ground and negatively affects native desert annuals..

LIFE HISTORY Saharan mustard is a winter annual, meaning that most of its life cycle is complete by spring. Saharan mustard germinates strongly in response to above-average rainfall; wetter years can result in population "explosions". On the other hand, like many other many native and non-native desert annuals, fewer Saharan mustard plants germinate in dry years. The species seeds heavily: in one study, Saharan mustard produced approximately 1,000 seeds per plant, but ranged up to 16,500 seeds per plant. Seeds can also remain dormant for several years. When wet, seeds develop a sticky, mucilaginous seed coat that aids dispersal.

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LEAVES are opposite and have heart-shaped bases. They are 4-10 cm long and 2-4 cm wide.

2014 Adrienne Simmons

©2012 Bob Sikora

FLOWERS are white, and clustered into heads measuring 6-8 mm across.

SIMILAR SPECIES There are four species of *Ageratina* in CA; three are native. **Desert ageratina** (*A. herbacea*) is rare in San Bernardino Co, but it isn't known from the SoCA Mtns: it's been collected only from the Mojave National Preserve. Desert ageratina is similar to eupatory, but has shorter leaves (1.5 to 5.5 cm) and petioles (0.5 to 1 cm).

©2010 James Andre

Desert ageratina, NATIVE, RARE

Sunflower family

Eupatory *Argeratina adenophora*

2014 Adrienne Simmons

HABIT Perennial or sub-shrub; lower stems may be woody. Stems are purple-tinged. Elevation < 1,000 m (3,280 ft).

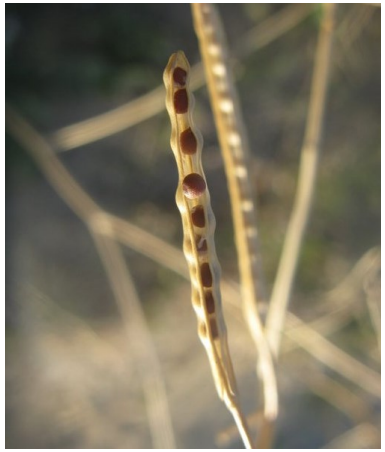
ORIGIN, DISTRIBUTION AND ECOLOGY Eupatory is native to southern and central Mexico. It was introduced to many parts of the world as an ornamental throughout the 19th and 20th centuries. Eupatory is now invasive in tropical and subtropical regions, including in China, southeast Asia, coastal Australia, and the Pacific Islands.

ECOLOGY In CA, eupatory is especially problematic in coastal areas. It can be found in canyons and riparian areas, on hillsides, and in disturbed places.

LIFE HISTORY Like other members of the sunflower family, eupatory seeds have an attached feathery structure called a *pappus*. The pappus aids dispersal by wind. Seeds of eupatory may also be carried by animals or may stick to clothing and vehicles. A single plant may produce 7,000 to 10,000 seeds.

©2009 Thomas Stoughton

FLOWERS (Dec. - June) are yellow and have four petals. Petals are 4-7 mm long and 1.5-2.5 mm wide.



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FRUITS (Feb. - Sept.) are linear and 3-7 cm long. At maturity, seedpods spread away from the stem.

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HABIT Annual. Elevation < 800 m (2,624 ft). **BASAL LEAVES** are deeply lobed and covered with stiff hairs.

SIMILAR SPECIES Compared with black mustard and slender mustard, Saharan mustard has longer fruits which spread away from the stem. **Mediterranean cabbage** (*Brassica fruticulosa*, not pictured) has been collected in the South Coast region and from scattered locations in the Transverse Ranges. The hair leaves of Saharan mustard have 4-10 pairs of lobes; Mediterranean cabbage leaves are smooth and have ≤ 4 pairs of lobes.

Mustard family

Shortpod mustard *Hirschfeldia incana*

2014 Mary Crawford

2014 Mary Crawford

HABIT Annual or perennial. Elevation < 2,000 m (6,560 ft). Leaves and stems are covered with unbranched hairs.

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LEAVES (basal) have 1-6 pairs of lobes. **FRUITS** are shorter (0.7-1.7 cm long, not including the pedicel) and thinner (1-1.7 mm) than those of black mustard. They remain upright and close to the stem.

DISTRIBUTION Black mustard and shortpod mustard are largely absent from arid regions of CA, but occurs throughout the rest of the state. Both species grow in fields and disturbed areas. Although these two mustards are in different genera, they can be difficult to tell apart. Shortpod mustard grows at higher elevations than black mustard. The basal leaves of shortpod mustard often have more pairs of lobes than of black mustard.

Spurge family

Terracina weed *Euphorbia terracina*

©2007 Luigi Rignanese

©2007 Luigi Rignanese

HABIT Annual or perennial; several stems grow from the base. Elevation <160 m (524 ft). This species is widely called “Geraldton carnation weed”. **LEAVES** are finely toothed, with tips are pointed..

SIMILAR SPECIES Fourteen species of *Euphorbia* occur in CA. Leafy spurge and Geraldton carnation weed have a whorled inflorescence and alternate leaves. They can be confused with several species of native spurge. These native spurges have a whorled inflorescence and alternate cauline leaves, but their leaves are circular or spoon-shaped and do not have pointed tips. Below are two photos of *Euphorbia lurida*. The photo at right shows the inflorescence and fruits (this specimen had been in the fridge for a while). The photo at left shows the rounded, alternate leaves.

2014 Mary Crawford

2014 Mary Crawford

Spurge family

Leafy spurge *Euphorbia virgata*

USDA APHIS PPQ Archive

L. L. Berry

HABIT Perennial. Elevation < 1,400 m (4,593 ft). Cauline are alternate, although the *bracts* (leaf-like structures) below the flower and inflorescences are whorled. **LEAVES** are linear, and their edges are smooth, not toothed.

ORIGIN AND DISTRIBUTION **Leafy spurge** is known from only scattered locations around the state; in the South Coast region, it's been found a few times on the Angeles NF as well as in Los Angeles and San Diego Cos. Leafy spurge is native to Eurasia. **Geraldton carnation weed** was first collected in SoCA in the late 1980s, and is spreading extremely rapidly in areas of Los Angeles Co. and along the Malibu coast. The species is native to the Mediterranean.

ECOLOGY AND LIFE HISTORY **Leafy spurge** infests rangelands and praries, and it's most widespread in the Northern Great Plains. Cattle avoid grazing leafy spurge, but sheep and goats find it palatable and may help to control populations. The structure of leafy spurge seed capsules allows seeds to be ejected up to around 13 ft. Leafy spurge is also known as *Euphorbia esula.* In SoCA, **Geraldton carnation weed** has been found in coastal sage scrub and riparian woodlands. Seeds of Geraldton carnation weed do not require periods of dormancy in order to germinate.

Mustard family

Black mustard *Brassica nigra*

©2009 Zoya Akulova

©2009 Zoya Akulova

HABIT Annual. Elevation < 1,500 m (4,900 ft). Stems are branched. **FLOWERS** look like those of shortpod mustard; they're yellow and have four petals. **FRUITS** of black mustard are generally longer (1-2.7 cm) and wider (1-5-4 mm) than those of shortpod mustard. (Those measurements don't include the *pedicel,* or stalk of the fruit). Fruits remain close to the stem. In the picture above, you can see the *terminal segments* at the end of each fruit. They're narrow, linear, and generally 2-5 mm long. Compare them with the fruits of black mustard.

SIMILAR SPECIES There are six other species in the genus *Brassica* in CA. *B. napus* (the source of canola oil), *B. juncea* (the ingredient in table mustard) and *B. oleracea* (cabbage) are important crop species. **Field mustard** (*B. rapa*) has leaves that clasp the stem.

©2008 Kier Morse

©2008 Kier Morse

Field mustard, NON-NATIVE, CAL-IPC rating =Limited

Mustard family

Tumble mustard *Sisymbrium altissimum*

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HABIT Annual or biennial. Generally 1-4 ft tall. Dead stems persist into fall and winter. Elevation < 2,700 m (8,860 ft).

ORIGIN AND DISTRIBUTION Tumble mustard is native to Eurasia. It's very common in the SoCA mountains and is considered weedy. Tumblemustard can be found throughout the western U.S.

ECOLOGY AND LIFE HISTORY Tumble mustard is often found along roadsides and old dozer lines. Dead stalks persist and are identifiable into winter. The dead stems of tumble mustard can break off at the base and blow across the landscape, dispersing seed in the process.

NOTES No *Sisymbrium* are native to CA. Of the six species that occur in the state, five are known from the SoCA mountains. Characters of the *pedicel* and fruit are important for identification to the species level. The pedicel is the stalk of a flower or fruit.

Linda Wilson

2014 Adrienne Simmons

LEAVES are blue-green and up to 6 cm long. They are alternate or not quite opposite. The tips are pointed.

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FLOWERS (May-Sept.) are yellow. A downward-pointing projection grows from the base of the flowers. The flowers are up to 5 cm long, including the projection.

SIMILAR SPECIES Like Dalmatian toadflax, **yellow toadflax** (*Linaria vulgaris*) has yellow flowers. However, compared with Dalmatian toadflax, yellow toadflax has more slender, linear leaves. Yellow toadflax is spreading in parts of NorCA, but hasn't been found in SoCA.

©2009 Steven Thorsted

Yellow toadflax, INVASIVE

Plantain family

Dalmatian toadflax *Linaria dalmatica*

Utah State University Archive

HABIT Perennial herb up to 4 feet tall. Elevation < 2,080 m (6,824 ft).

ORIGIN AND DISTRIBUTION Dalmatian toadflax was introduced from the Mediterranean region as an ornamental. It's found sporadically in most of western CA. So far, Dalmatian toadflax isn't widespread in the SoCA mountains, but it is a major concern to land managers.

ECOLOGY Dalmatian toadflax can be found in disturbed places such as roadsides, forest clearings, and agricultural fields. It also occurs in natural habitats such as pinyon/juniper woodland and sagebrush scrub. Dalmatian toadflax is resistant to fire, which may facilitate its spread.

LIFE HISTORY Dalmatian toadflax grows and reproduces from seed and from spreading roots. Seeds can remain viable for up to 10 years. Dead stems containing seed capsules can remain standing for over a year.

2014 Mary Crawford

pedicel

2014 Mary Crawford

FRUITS are linear and 4.5 - 12 cm long. The width of the pedicel equals the width of the fruit.

2014 Mary Crawford

2014 Mary Crawford

BASAL LEAVES (at the base of the plant) are deeply lobed with pointed teeth. Leaf lobes become thread-like towards the top of the plant (right).

SIMILAR SPECIES **London rocket** (*Sisymbrium irio*, pg. 66) is widespread at lower elevations in SoCA. Compared with the other mustard genera (*Brassica, Hirschfeldia*, and *Lepidium*) in this guide, tumble mustard and London rocket have deeply-lobed to compound leaves with linear, pointed leaflets.

Mustard family

London rocket *Sisymbrium irio*

2006 Chris Wagner/SBNF

©2010 Zoya Akulova

HABIT Annual up to 2.5 ft tall. Elevation < 1,700 m (5,577 ft).

©2009 Thomas Stoughton

©2005 Luigi Rignanese

FRUITS are narrow and linear (2.5-5 cm long and about 1 mm wide). The young fruits overtop the flowers.

DISTRIBUTION London rocket is abundant and spreading in many parts of SoCA, especially in desert regions. However, it's limited to lower elevations and isn't widespread in the mountains. It is uncommon or absent from most of NorCA.

NOTES Compared with tumblemustard, London rocket has a more erect growth form. The *pedicel* is narrower than the fruit (see pgs. 64-65 for explanation).

Pink family

Soapwort, bouncing bet *Saponaria officinalis*

©2008 Keir Morse

Neal Kramer

HABIT Perennial. Elevation < 2,200 m (7,218 ft). **LEAVES** are opposite and 3-10 cm long.

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2014 Mary Crawford

FLOWERS (June-Sept.) are white or pink and have five petals.

DISTRIBUTION AND ECOLOGY Soapwort is native to southern Europe and was introduced to the U.S. as an ornamental. In CA, it occurs in coastal regions, the northern Sierra Nevadas, and the Great Basin, but seems largely absent from central CA and the desert regions. Soapwort has escaped cultivation in some areas and become weedy, and is especially problematic in the Mono Lake Basin near Yosemite National Park. However, in the Transverse and Peninsular Ranges, it doesn't seem to be aggressively invading wildlands.

Oxalis family

Bermuda buttercup *Oxalis pes-caprae*

©2010 Thomas Stoughton

HABIT Perennial with bulbs on its roots. Elevation < 820 m (2,700 ft). **LEAVES** are compound, with 3 heart-shaped leaflets.

Barry Rice

Barry Rice

FLOWERS have five yellow petals.

ORIGIN AND DISTRIBUTION Bermuda buttercup is native to South Africa, and was introduced to CA as an ornamental. In CA it occurs mainly in coastal regions, but it is spreading in many areas. Its been collected from lower elevations along the cismontane slopes of the SoCA mountains.

LIFE HISTORY Bermuda buttercup hasn't been found to produce viable seed in CA; it seems to spread only by growth and movement of its roots and bulbs.

Mustard family

Clasping pepperweed *Lepidium perfoliatum*

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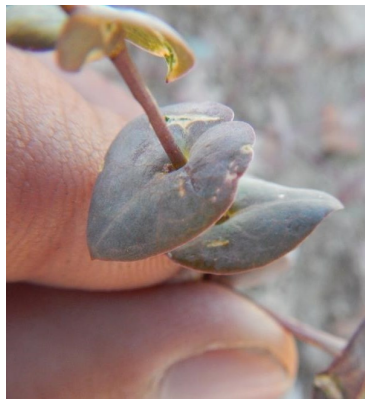
HABIT Annual/biennial up to 1.6 ft tall. Elevation < 2,450 m (8,038 ft).



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LEAVES clasp the stem and have rounded, heart-shaped bases. Basal leaves (not pictured) are deeply lobed and divided. **FRUITS** are round.

ORIGIN, ECOLOGY AND LIFE HISTORY Clasping pepperweed was introduced from Eurasia and North Africa. It's found on roadsides, agricultural fields, meadows, pinyon/juniper woodland, and sagebrush flats. Clasping pepperweed reproduces by seed. Dead fruits can remain on the plant into the fall.

NOTES Clasping pepperweed is easy to identify because its heart-shaped cauline leaves clasp the stem.

Mustard family

Perennial pepperweed *Lepidium latifolium*

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HABIT Branched perennial up to 6.5 ft tall. Elevation < 2,500 m (8,200 ft). Plants may have woody bases.

ORIGIN AND DISTRIBUTION Perennial pepperweed is native to Eurasia and was first collected in CA in 1936. It's unclear exactly when or how it was introduced to the state. It now occurs throughout most of CA, although it's absent from desert regions.

ECOLOGY Perennial pepperweed has been documented in a wide variety of habitats. It can be found in meadows, riparian areas, and wetlands, and is tolerant of saline conditions. It also grows on drier sites. Because it spreads clonally, monocultures of perennial pepperweed can develop in a relatively short time.

LIFE HISTORY Perennial pepperweed produces large numbers of seed, and also spreads vegetatively. Plants have extensive root systems; new plants grow from spreading shoots.

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Leaves of young plants form a basal rosette (above, left). Mature plants have finely-toothed cauline leaves.

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FLOWERS (June - Sept.) are white. The petals are < 2.5 mm long.

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FRUITS grow on short stalks and are circular.

SIMILAR SPECIES There are about 26 species of *Lepidium* in CA; 10 are non-native. *Lepidium* can be a difficult genus. Perennial pepperwed is distinguished by its shrubby growth form (it often has a woody base), fruits that *dehisce* (break open) when ripe, and basal leaves that are finely toothed but not deeply lobed.